ENTOMOLOGICAL SOCIETY OF BRITISH COLUMBIA

E. O. ESSIG

PROCEEDINGS

OF THE

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OF

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JULY, 1915

NUMBER 7, N.S.

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PART I.

BRITISH COLUMBIA ENTOMOLOGICAL SOCIETY

SECOND MIDSUMMER MEETING, 1914

THE second midsummer meeting of the British Columbia Entomological Society was held at Kelowna, B.C., on August 20th, 1914. The First Vice-President, Mr. Lionel E. Taylor, was in the chair.

Mr. Taylor: If the meeting will now come to order, we will begin the business of the day. It gives me a great deal of pleasure to welcome you to-day to the Kelowna District, and I hope the fruit-growers of the district in general will profit from the discussions that I am sure will follow each of the papers on the programme before us. I have been requested to give an outline on the problems, entomological and pathological, that require solution in our orchards at the present time.

Mr. Taylor then proceeded to address the meeting on the lines he would suggest as liable to render the most aid to the fruit-grower in his locality. He dwelt on some of the problems of the plant pathologist that require solution, in particular referring to the diseases known as pear-wilt, water-core, fruit-pit, and other conditions directly and indirectly resultant from irrigated conditions affecting fruit-trees. He also touched on the insect troubles of obscure origin, mentioning the blight-carrying proclivities of insects, the apple-blotch mite, tarnished plant-bug, tree-crickets, and locusts. Mr. Taylor also mentioned the methods that would appeal to him in instructing the fruit-grower as to his insect and fungous troubles, and condemned the principle of short daily meetings, and advocated meetings more of the short-course nature. He also suggested that a chart be drawn up and circulated among the fruit-growers showing the sporing periods of fungous diseases and the hatching periods of insects.

Mr. J. W. Eastham: In regard to Mr. Taylor's suggestion that fruit-growers be advised as to dates of spraying, it is needless to say that the time to apply depends on the condition of the crop plant at the time, and this in a large measure determines the date in a locality. Take, for instance, the peach-leaf curl. We say spray before bud-scales are open, and this necessarily depends on the season. Given a very early season, growers may not be prepared. To give the farmer dates of sporing of his fungous diseases would be useful, no doubt, but it is not a main consideration. It would be a poor guide and growers might be misled. In regard to the more obscure troubles of the orchard, the blotching of apples is caused, according to Mr. Brittain, last year, by a species of mite. We have not found this mite this year, although the same conditions are noted. Lime-sulphur as a control does not work as well as might be supposed or hoped. The Kootenays have the same condition. As regards the disease termed "pear-wilt," we have no opinion to offer. It is a new condition to me. We hope to work on it this coming year. Fruit-pit and water-core are physiological diseases and control is difficult. It might be interesting for you to hear that watered core can be restored to normal condition, provided the water has not reached the seed-cavities. Apples may be picked and stored and the water absorbed.

Mr. Treherne: In regard to the point raised as how to assist the farmer in his troubles, I need hardly say that it is one of the prime objects of the meetings of this Society in the summer-time to work with and help the fruit-grower to the best of our ability. It is a disappointment that more do not come to these meetings if there are complaints as to instructional work. We are trying to develop our own literature, especially relative to our local conditions, but this takes time, and we are a young Society and entomology in the Province is young. There is plenty of literature from outside sources which approximate our conditions, and those insects which are to-day causing most loss in this valley are already well studied. We have several, however, which are peculiar to this country which require study, but study of this kind necessarily takes time for sound results.

Mr. Hereron: What we need is compulsory spraying. All fruit-growers should spray. Mr. Treherne is quite right; available literature is to be had.

Mr. Crease: Occasionally we have sudden outbreaks to meet which require special treatment on the spur of the moment. We cannot always foretell outbreaks. Many of you know we have had a great deal of trouble with grasshoppers, especially in the Glenmore orchards. The ranges have dried up and the insects are undoubtedly hungry. I can inform you that Bordeaux mixture 4-4-50 will control grasshoppers absolutely.

Mr. Cunningham: I have been impressed with the points raised. One point in particular should be carefully considered. Why are we not succeeding better in the matter of the control of our orchard troubles? In the early history of this Province fruit-growers had to work out their own troubles and conducted their own business. Farmers' institutes now do the work, and the fruit-growers have become dependent. Poultry, live stock, etc., are all mixed up, instead of settling on horticulture and giving all our efforts to horticulture. I hope we will be able to draw a distinction between fruit-grower and farmer; there is a difference. Mr. Crease is quite right about the grasshoppers and deterrents. Arsenicals are not so good. Heavy rolling of adjacent lands in spring will destroy grasshoppers. In regard to the pathological diseases, irrigation has a most direct bearing.

Mr. Tom Wilson: Grasshoppers this year are a burden. In the Similkameen country the crops are eaten off. Patches of cabbages, etc., are being protected by trapping. This has given good results, for when in numbers many are killed. They are appearing in clouds and clover lands are bare. All this is due to climatic reasons and drought. I have also noted that many trees around Armstrong and Enderby have had their twigs injured. It is a mechanical injury.

Mr. Taylor: Rolling grass for grasshoppers is good. Locusts in South Africa are destroyed that way. When eggs are observed being laid in the soil a report is sent to the Bureau of Agriculture, where a map is being kept showing every farm where eggs have been laid. These eggs will hatch out next year after a rain. Weather reports are kept, and as rain falls men are sent out to get the locusts. The locusts advance in millions, and the men go ahead of the horde with a water-cart and spray a width with arsenite of soda and sugar. All are killed. The locusts are gathered for poultry-feed or are made into flour for food by the Kafirs. As regards farmers institutes, it is my conviction that they are of little value. They may be good lecturers, but the time is too short and the average farmer has no knowledge to take all issues in. Take, for instance, a lecture on fertilizers. Unless one knows chemistry the lectures are of little avail. I advocate short courses for fruit-growers. Even if you only get six to ten men interested, they would impart information and the locality would be helped.

I would like to say, before closing the discussion, that previous to the meeting I met the Hon. Price Ellison, and he wishes me to convey to you all his best wishes for your success, as he is entirely in favour and appreciates the value of our work as a Society. (Applause.)

I will now call on Mr. Ruhman to present his paper. Mr. Ruhman has been appointed assistant to Mr. Eastham in the Pathological Laboratory at Vernon.

INSECT-NOTES FROM THE OKANAGAN IN 1914.

BY MAX RUHMAN.

Mr. President, Ladies, and Gentlemen,—I was asked by our worthy Secretary to prepare a paper on the "Comparative Prevalence of Insect Pests in Various Parts of the Okanagan." Not having had the opportunity to make a survey of the various districts, I am compelled to use a considerable amount of data collected by others. I will first take those pests which occur generally throughout the valley.

THE TARNISHED PLANT-BUG (*Lygus pratensis*).

This pest seams to be increasing to an alarming extent in the Okanagan Valley, and I think that the Capsids of British Columbia should receive more attention than they appear to be getting. I fear that a great deal of the killing of fruit buds and blossoms which occurred so noticeably this spring must be placed to the credit of the Capsids. I have no positive proof that the injury was caused by them, but the nature of the punctures at the base of most of the buds examined leads me to come to this conclusion.

THE PEAR-LEAF BLISTER-MITE (*Eriophyes pyri*).

This pest is very noticeable in most orchards where pears are grown; the pest is of considerable importance, but is easily controlled.

THE WOOLLY APHIS OF THE APPLE. (Through recent studies in Maine this pest was proven to be only another form of the elm-aphis (*Eriosoma ulmi*); this, therefore, is now the technical name.)

This pest is present in all the older orchards throughout the valley, the amount of infestation being regulated principally by the care the individual orchards receive; the elm-tree form being particularly noticeable in Vernon and Kelowna. The root form is not so often met with.

THE GREEN APPLE-APHIS (*Aphis mali*).

This pest is very common and doing a great deal of injury; it is, on the whole, the most widespread pest we have. The amount of injury done to individual orchards is generally according to the amount of attention given to the control of the pest—too frequently none at all. A mixed spray of lime-sulphur and Black Leaf 40 applied as the buds are opening is, I think, the most effective spray for the control of this pest.

THE RED SPIDER (*Tetranychus bimaculatus*).

This pest is found abundantly wherever prunes are grown in the valley, and is particularly noticeable and injurious in Vernon and Kelowna.

THE OYSTER-SHELL SCALE (*Lepidosaphes ulmi*).

Is particularly prevalent in low-lying moist places on uncleared land. Crab-apples seem to be most affected. In orchards it is met with more often than desirable, particularly in Vernon and Kelowna. Young orchards that receive a reasonable amount of care seem to be entirely free.

THE CABBAGE-APHIS (*Aphis brassicæ*).

Very common and destructive everywhere on cabbage and turnip. Little effort seems to be made to control this pest.

THE CABBAGE-WORM (*Pontia rapæ*).

Common everywhere; little effort is made to control until too late.

THE RED-HUMPED APPLE-WORM (*Schizura concinna*).

General and quite common some years, but easily controlled.

THE BLACK CHERRY-APHIS (*Myzus cerasi*).

Fairly abundant everywhere; our most important cherry pest.

THE CURRANT-APHIS (*Myzus ribis*).

This pest is general and of considerable importance.

THE FLEA-BEETLE (*Epitrix subcrinata*).

General and doing considerable injury to tomatoes and potatoes, both directly and indirectly.

THE PLUM-SPHINX (*Hyloicus drupiferum*).

General; the larvæ sometimes found stripping young apple-trees.

THE CHERRY-TREE TORTRIX OR UGLY NEST (*Archips cerasivorana*).

General; very abundant on choke-cherries in the Vernon District this year.

THE FRUIT-TREE LEAF-ROLLER (*Archips argyrospila*).

General; fairly numerous in both Kelowna and Vernon this year.

THE CLICK-BEETLES.

Quite a number of species of the Elaters are general throughout the valley, and doing considerable damage by feeding on the buds and opening leaves of young apple-trees—*Corymbites inflatus* being probably the most prominent. *Cardiophorus fenestratus* has so far only been reported from Shorts Point by Mr. W. H. Brittain as injuring young trees.

THE SPRUCE GALL-LOUSE (*Chermes sp.*).

Is noticeable in all districts and frequently does considerable injury to ornamental spruce-trees.

THE APPLE-LEAF HOPPER (*Empoasca mali*).

This pest is very abundant throughout the valley; their work on the leaves and their egg-punctures on the young wood is very noticeable everywhere. Some efforts seem to be made to control this pest, but in most cases the spray is applied at the wrong time; the only time spraying is effective is if the spray is applied when the hoppers are still in the nymph stage; spraying at other times is a waste of time and good material.

THE TENT-CATERPILLAR (*Malacosoma pluvialis*).

General, but not so abundant as usual this year.

THE PEAR-SLUG (*Eriocampoides limacina* Retz).

General, but not so abundant as in other years. It is strange that a pest so easily controlled is so generally neglected year after year.

THE LESSER APPLE-WORM (*Enarmonia prunivora* Walsh).

This little pest is general, but appears to be kept well in check.

THE FALL WEB-WORM (*Hypantria cunea*).

General; fairly abundant again this year on both apple-trees and wild shrub, particularly in the Vernon District.

THE STRAWBERRY-ROOT WEEVEL (*Otiorhynchus ovatus*).

Though present generally, does not appear to be in sufficient numbers to do a great deal of harm. Grand Forks, in the Boundary District, has some quite serious local infestations.

THE ROSE-LEAF HOPPER (*Typhlocyba rosæ*).

Abundant on both the wild and cultivated roses throughout the valley.

THE ONION-THRIP (*Thrips tabaci*).

General, and quite serious, particularly in Kelowna this year.

These are the more important pests observed or reported generally, except the grasshoppers, which are certainly plentiful enough to be taken notice of. Mr. Ben Hoy reports on the 14th that he visited a small orchard surrounded with range land practically defoliated by grasshoppers (species not identified) in Kelowna. I will now take the insects observed or reported locally.

A PLUSIA (*Plusia californica*).

From Larkin, Vernon, Kelowna, Summerland, and probably Armstrong. My attention was first attracted to the larvæ of this *Plusia* in Kelowna on June 2nd, where I found it doing a great deal of damage in a market-garden, lettuce-plants being particularly attacked and completely ruined. Although general in Kelowna, I did not find any other places seriously infested, neither did I receive any later reports to this effect. My attention was next called to it on June 10th in Larkin, where a 100-acre field of alfalfa had just been cut, and millions of the larvæ were migrating to an adjoining alfalfa-field, and in transit cleaning up the home vegetable-garden; sweet corn being immune from their attack, potatoes nearly so, lettuce and peas being preferred, onions being also attacked, and large numbers were climbing on the walls of the house. The attack on the home garden seemed to be the cause of attention being first drawn to them. The same day I was called to an orchard in Vernon where alfalfa and clover was growing between the tree-rows; here they were also present in great numbers, particularly on the alfalfa, and considerable numbers were on the fruit-trees, attacking both foliage and fruit and doing considerable damage. The larvæ appeared to be coming from the weeds in an adjoining orchard which was in a state of neglect. I collected in all 200 larvæ in various stages of growth and placed them in breeding-cages; a few commenced to pupate on June 12th. A disease attacked the larvæ and large numbers were also parasitized, with the result that only eleven larvæ reached the pupal stage; the rest succumbed to the disease or parasites. Out of the eleven pupæ only four adults emerged; from the other seven pupæ Tachinid flies emerged; in the case of pupæ of larvæ taken in Kelowna, Braconids emerged. Of those pupæ parasitized by Tachinids only one parasite emerged from each pupa, whilst in the case of parasitized larvæ which did not reach the pupal stage two Tachinids emerged from each. Out of the 200 larvæ taken only 2 per cent. reached the adult stage, and apparently the results were somewhat similar in the field, as a second brood of larvæ was not noticeable and only very few adults were observed. A specimen also reached me from Summerland, but nothing serious reported from there. A report of a serious invasion of the army-worm reached me from Armstrong, but did not get the opportunity to investigate, neither did I receive any specimens from there, but from the descriptions I received of the larvæ I am led to believe that it was the same *Plusia* as I observed in Larkin, Vernon, and Kelowna.

THE CODLING-MOTH (*Carpocapsa (Cydia) pomonella*).

An incipient local infection in Kelowna. Mr. Cunningham with his usual thorough methods, will probably have it exterminated by next season.

AN APPLE-SAWFLY (*Taxonus nigrosomia*).

I first observed larvæ of this sawfly in September, 1912, in Armstrong, and Mr. W. H. Brittain found them about the same time in Vernon. The full-fed larvæ apparently come from the bush adjoining the orchard, evidently for the purpose of finding a place to hybernate in, and had selected an Ontario and a Wagener tree for the purpose. Every apple on the Ontario tree had either one or two larvæ; the Wagener apples only had a few; a hole was eaten into the fruit slightly deeper than the length of the larva, after which the larva either remained quiescent or left the fruit for more comfortable quarters. Mr. Brittain bred some of the larvæ and had them named.

The Mealy Plum-aphis (*Mylopterus arundinis* Fab.).

Taken in Vernon.

The Imported Currant-borer (*Ægeria tipuliformis*).

Reported as plentiful at Creston, in the Kootenays. Have found currant-canes in both Vernon and Kelowna infested with larvæ apparently of this moth, but reared no adults. I saw a few moths which appeared to be *A. tipuliformis* flying over currant-bushes at the end of May in an orchard in Kelowna, but none were taken.

The European Fruit-scale (*Aspidiotus ostræformis* Curtis).

Quite plentiful in the bush around Penticton, also on the Indian reserve at the same place. Has been reported on pear at Kelowna.

The Rosy Apple-aphis (*Aphis sorbi*).

Found at both Vernon and Kelowna.

The Currant Fruit-fly (*Epochra canadensis* Loew.).

Rather plentiful at Vernon.

The Onion-maggot (*Pegomia ceparum* Bouche).

Present in small numbers in some Vernon gardens.

The Cabbage Plutella or Diamond-back Moth (*Plutella maculipennis*).

A number of larvæ of this little pest were sent from Armstrong, where considerable damage is reported on cabbage and turnip. This little moth is an importation from Europe, where I have at different times noticed considerable damage being done to young plants by the first brood. It makes its appearance at the end of May in British Columbia, and we get two broods, possibly three; in the Southern States five broods are reported, and I understand that in Florida broods are continuous the year round. I have found preventive measures the best means of controlling this pest—that is, by burning all the leaves and stalks of cruciferous plants left on the field after harvest in the fall. Cleanliness is as important as a preventive of pests and disease in the field as in the house and barn. The oldest reports I can find on this insect from the United States are dated 1877, by Cyrus Thomas. Out of fourteen pupæ I bred six adults and eight Braconids.

The Stalk-borer (*Papaipema nitella* Gn.).

The larva of this Noctuid was reported as doing considerable damage to young celery-plants in Armstrong; it is known to attack a large variety of plants; one larva may do considerable damage by migrating from plant to plant. As the eggs are laid in the fall on the stems of various weeds and grasses, preventive measures are obvious and easy, as the larvæ do not migrate very far. Keep your vegetable-garden and its near vicinity free from weeds and grasses. No adults were reared.

Mites (*Eriophyes sp.*).

A considerable amount of injury was done to apple and cherry leaves by a mite. Leaves brought in showed at first glance the typical appearance of silver-leaf, but on closer examination proved to be the work of mites, which were present in large numbers on both sides of the leaves. The attention of the growers was drawn by the wilting of the leaves as if suffering from drought, though plenty of moisture was present.

A Sap-feeding Beetle (*Ips quadriguttata*).

This beetle was prominent in injuring the blooms of asters in several Vernon gardens.

The Carpet-beetle or Buffalo-moth (*Anthrenus scophulariæ* L.).

Larvæ of this beetle were brought in for identification from Vernon, a house and stable being badly infested.

THE BUD-MOTH (*Tmetocera ocellana*).

This pest, although as yet only reported from Kelowna, is probably more widespread in the valley, is of great economic importance, and care should be taken that it is not allowed to become a serious pest here.

BUD-WEEVILS (*Cercopeus artemisiæ and Minetus setulosus*).

Feeding on buds and opening leaves of apple-trees at Penticton.

THE FLAT-HEADED CHERRY-TREE BORER (*Dicerca divaricata*).

Only reported from Vernon, where two specimens were taken by Mr. W. H. Brittain in 1912.

THE PEACH-TREE BORER (*Sanninoidea exitiosa*).

This pest is only reported from Summerland, where a considerable number of trees have been killed by it; probably present to some extent in all the peach districts.

THE PEACH-TWIG BORER (*Anarsia lineatella*).

A serious pest in the southern Okanagan, and very abundant this year, probably owing to neglect of thorough spraying.

Mr. Lyne: To review all the insects mentioned by Mr. Ruhman would consume several days. I will confine my attention to those of most importance. The *Plusia* generally occur spasmodically owing to the extent of parasitism they are subject to in this country. Onion-thrips are very prevalent this year in Kelowna, and affected fields are especially easy to notice owing to the sickly greyish discoloration of the leaves and stalk of the onion. The result has been a reduction of growth. Onion-ground should be ploughed in the fall, the idea being to make it a difficult matter for the adults in the soil to emerge next season. Stir soil during the winter, if possible, to let the frost act. Except for the presence of the codling-moth in this locality, the peach-twig borer is very prevalent and destructive and most important. Unless spraying is done very few sound peaches will be found next year. We know this insect as very serious. This Society is posted as to procedure, for the life-history was published last year in Bulletin No. 3 of our series. Methods of combating this pest will be found in the account. The larvæ hibernate or pass the winter in crotches of the tree under bark, etc. The peach-root borer is another injurious insect of prime importance. The larvæ attack apricot and plum, as well as peach. These larvæ, which may be found around the root, and a mass of gum will indicate their presence, and must be cut out by hand, using a curved bladed knife for the purpose. An account of this insect appeared in Bulletin No. 3 of last year's proceedings. Copies of this bulletin can no doubt be obtained from the Secretary at any time.

THE CONTROL OF INCIPIENT INFESTATION OF CODLING-MOTH IN A NEW DISTRICT.

BY W. H. LYNE, ASSISTANT PROVINCIAL INSPECTOR OF FRUIT PESTS.

The most practical method of dealing with a local incipient infestation of codling-moth depends upon the particular season of the year at which the infestation is discovered, and the time decided upon to commence operations with a view to its extermination. I need hardly preface my remarks by saying that it is the first object of this Department to exterminate an outbreak of this moth immediately on its arrival, for the Department has been brought up side by side with the growth and development of the fruit-growing industry of the Province.

So far experience has taught us that there are only two drastic methods that will give satisfactory results. One of these consists *in destroying every particle of fruit within the infected area during the early summer*, in order to prevent the larva

completing its life-cycle and carrying the infection over to another season. It should be realized, at this point, that our Province is now practically free of codling-moth; consequently, with our staff of fieldmen posted in various parts of the country, we are for the most part able to "spot" an infestation before it has had an opportunity to get ahead of us. This point should be thoroughly realized, otherwise my few remarks may appear to be too theoretical, whereas they actually represent past experience and fact. The other recourse is that of *systematic spraying with arsenate of lead, banding the trees, and a rigid quarantine of all fruit within the infected district.*

It often happens that the infection is not discovered until late in the season at a time when the first brood of larvæ have had their "innings" at the fruit, and many of them have already passed the pupa stage and new moths are on the wing. This could happen as early as the month of August in this latitude. Under these circumstances it would be very foolish to proceed with the destruction of the fruit unless the area was very small indeed. Because by the time the area of infection could be ascertained and every particle of fruit destroyed the second brood would be so far under way as to give many of the larvæ an opportunity to leave the fruit, spin their cocoons in a small hiding-place under the bark or elsewhere, and there remain until the following season, and the great sacrifice of fruit would not have resulted in utter extermination. So if the destruction of the fruit is the method to be adopted, with a view to utter extermination, as a reward for the sacrifice, it will be necessary to start destroying the fruit so early in the season as to ensure the destruction of every particle before the season is far enough advanced to allow any larvæ the chance to winter over.

This work of destroying the fruit is not nearly so simple a process as the mere mention of it might lead people to believe. Any experienced apple, pear, crab, or quince grower will agree that, even when harvesting the matured fruit is over, they will often think every bit of fruit on a certain tree had been gathered, to find when the tree finally loses its foliage that many specimens remain still adhering. This will give one an idea of how much more difficult it is to thoroughly dispose of partly developed fruit at the time it is necessary to make a thorough clean-up. It is also hard to realize the amount of opposition and refusal to co-operate on the part of many of the people whose future interests are at stake. Without the thorough and hearty co-operation of every one concerned, the extermination of the codling-moth is very difficult, if not impossible, as a very little fruit allowed to remain in the trees or even on the ground throughout a scattered district may defeat this attempt to eradicate the infection.

To review the other method already mentioned, consisting of strict quarantine, inspection, banding the trees, and spraying, I will give the details that were carried out in dealing with an infected district of about one square mile in extent. The cause of infection was traced to a settler having arrived in the spring, with his household effects, from an infected district in Ontario, and the larvæ were carried in some of the packing-cases in the pupal form. It was not until the beginning of September that infection in three or four adjoining orchards was first discovered, many of the first brood of larvæ being found in cocoons under the bark of infected trees, and also some newly hatched larvæ in the fruit ranging from a few days old and upwards. Several apples were found in which larvæ had completed their work and left, accounting partly for those found under the bark in their cocoons. The trees averaged seven or eight years old, mostly Jonathans, McIntosh, and Wagener, all bearing considerable fruit. Four Assistant Inspectors were immediately ordered to inspect the whole district with a view to locating the exact area of infection. This proved to be one square mile in extent. No fruit was allowed to leave this district, and outside packing-houses were not allowed to send in any picking or packing boxes that would go into circulation again in outside districts or packing-houses. A temporary packing-house was erected in the infected district, to which

all fruit was ordered to be taken. During this time the Inspectors were still busy locating the infection, which proved finally to exist only in three or four orchards. When this condition was ascertained they were instructed to destroy every larva that could be found in the fruit, on the trees, or under the bark or crevices. The trunks and limbs of the trees were scraped clean of rough bark and banded with gunny-sack. As a further precaution, every apple, crab, pear, and quince was carefully inspected by our own Inspectors at the packing-house provided for the exclusive handling of fruit within the infested district.

After passing this inspection the fruit was packed and hauled direct to the cars to which they were consigned for shipment to points outside the Province. The following spring and summer every apple, crab, pear, and quince tree in the infected district received a thorough spraying with arsenate of lead, and during the balance of the season the orchards were patrolled by two of our Inspectors on the look-out for the first sign of reinfection, but none has been found during the last two years. This fact in itself speaks for the efficacy of the proceedings, and fortunately we are conscientious enough to recognize infection when it appears, and so may truthfully say we do not know that any codling-moth infection exists in the orchards above mentioned. Given a free hand and thorough co-operation on the part of the growers, we believe all normal infestations may be conquered.

Mr. Treherne: This admirable paper speaks for itself and represents a clear case of conscientious effort for the welfare of the Province. It has been frequently mentioned, privately and officially, that the cost of control and the wholesale total elimination of orchard pests is more than the cost would be to the grower if the pests were present. This is without doubt true, and probably, in some cases, the expense is greater, but the name and value of having clean fruit in the markets of the world is worth more than all the costs of control put together. It is largely a matter for the future, but undoubtedly the cash value will become apparent some day, and that not far distant. I should like to ask Mr. Lyne if he has practised the former method he mentioned—viz., the total purchase and condemnation of fruit in an area found to be infected.

Mr. Lyne: Why, certainly. We had a case last summer at Armstrong, brought to our attention first by Mr. Brittain. He observed in the month of June a larva in a fruit when the apples were still quite small. Immediately we went to work and rounded up the infection, which finally we found was confined to three orchards of approximately 800 trees, five- to eight-year-olds, of which, if I remember correctly, about twenty were actually found infected. We bought the crop outright on the trees in the early summer, amounting to approximately 1,000 boxes, and boiled the fruit in sacks in scalding water. Since then no further report of infection has come in from this district.

Mr. Taylor: How many outbreaks have occurred in the Province at one time and another?

Mr. Lyne: Four or five definite outbreaks have occurred.

A member: And do you consider the methods you advocate satisfactory under all ordinary conditions?

Mr. Lyne: So long as we retain the confidence and the co-operation of the fruit-growers, certainly. I may say we have been very fortunate in being able to catch incipient infestation so rapidly. So long as the codling-moth remains a rarity and we have an efficient orchard patrol, we will keep out the moth for many years yet.

Mr. Treherne: I am inclined to agree with Mr. Lyne that provided a careful orchard patrol is continued and Inspectors be properly informed, and the Department is properly endorsed by the Government, the matter of control of incipient infestation by codling-moth is simple, and growers should rely on and endorse the work. I may mention, however, that the moth is gradually working its way northwards from the State of Washington; hence, we cannot always hope to be immune from attack.

SPRAYS OF UP-TO-DATE INTEREST.

BY L. L. PALMER.

Among the different sprays, insecticides, and fungicides of proven value and in practical use are some of more recent date which, to the writer's knowledge, have not been extensively tried under Okanagan conditions. These I have been asked to discuss under the above title, "Sprays of Up-to-date Interest." Since many of them are worthy of long, detailed study, it will not be possible to consider the relative values of each at any great length.

The 1914 season found the fruit-growers of the Okanagan still fighting the same insect pests and diseases that troubled this district in 1913, and, in addition, many instances of new insects and previously unknown diseases have appeared to augment the already complex spraying problems; at least, it is correct to state that effective spraying was never in greater need by Okanagan fruit-growers than at present. Perhaps I should put the question more strongly and say, as I believe, that many growers have practised false economy in 1914 by neglecting to spray where so doing meant bigger crops, cleaner fruit, and healthier trees. Consequently, the question of sprays and spraying is of more vital importance than ever before.

Before entering into the subject of "Sprays of Up-to-date Interest," the writer wishes to prelude his remarks with this statement: Do not attempt new or untried sprays if the ones you are accustomed to are giving desired results. No matter how interesting or novel experimental spraying may be, on a commercial scale the average orchardist cannot afford it, and even if he could, from an economic standpoint, he would probably loose money. Still, in the Okanagan Valley many insect pests and diseases thrive unchecked, and the orchardist must in the future do more spraying. In the majority of orchard conditions in the valley I believe the common and well-known insecticides and fungicides, properly mixed or combined and sprayed in the correct season by men and machinery competent to do the work thoroughly and effectively, will control the chief economic insect pests and diseases.

However, there may arise, either through neglect or especially adverse climatic conditions, an orchard status which requires an exceptionally severe spraying or a spray combination which will positively not burn fruit or foliage. To meet such a necessity we have some new and interesting sprays, tested and proven in some other locality for the same reason for which we are trying them. A few such combinations are worth studying. But you must remember, after all, that they do not differ greatly from the common sprays to which you are accustomed, and some of them contain the same chemical compounds.

Since sprays composed of insecticides and fungicides, mixed or combined, and applied to the trees in one application are becoming more and more needed as the pests and diseases increase in number, the importance of the problem as to just which spray materials can or cannot be combined has also grown. I am therefore tabulating a few "dont's" for guidance in the combining of different insecticides and fungicides.

(1.) Do not combine Bordeaux mixture and Black Leaf 40 or other nicotine ingredients.

(2.) Do not combine Bordeaux and acid arsenate of lead. (NOTE.—Most standard arsenate pastes are acid arsenates and not safe in combination spraying.)

(3.) Do not combine lime-sulphur with acid arsenate.

(4.) Do not combine lime-sulphur with soap or kerosene emulsions.

(5.) Do not use atomic sulphur in place of lime-sulphur in dormant insecticide combinations.

(6.) Do not use any spray materials the purity or strength of which is in doubt.

The first four combinations may be used in dormant season with little danger, but for spring and summer application they are apt to be disastrous.

Among the most interesting and effective of the newer insecticides are the different oil sprays. These have been especially brought to our attention through

experimental and practical use in California. They are very closely allied to the common insecticide, "whale-oil soap and quassia-chips," and the more recent "kerosene emulsion."

The orchardist can obtain commercial oil emulsions and miscible oils of different penetrating strengths, just as he can buy commercial lime-sulphur of guaranteed strength, but, as in the case of comparative costs of commercial and home-made lime-sulphur, the commercial is a great deal more expensive. Even though this is an important economic fact, the average orchardist would do better by buying the prepared oil sprays than by attempting to make anything but the simplest oil emulsions on the ranch.

There are many factors hard to overcome in the home manufacture of oil emulsions. The ideal emulsion is undoubtedly one made from miscible oils, which are those made by mixing mineral oils of paraffin base with vegetable and some creosote oils, and are not oils in their natural crude state. In simple words, a miscible oil, or one which mixes uniformly in water and is therefore capable of dilution for spraying, is an oil for which a proper soap has been found for the purpose of emulsifying. Thus in British Columbia we can buy many different types, such as crude oil, topped crude oil, fuel and stove distillates, and kerosene, all of which need a different soap for proper emulsion.

Not only does each type of oil require different soaps, but the penetrating power varies greatly with the gravity strength of the oil, and therefore the amount of dilution necessary to prevent injury is hard to ascertain. Oil companies sell their products under certain tests indicated in degrees Baume. It must be noted that the higher the figure in degrees Baume, the lighter the oil. In measuring densities of liquids lighter than water, the Baume scale begins at 10, which is the density of water. For measuring liquids heavier than water, the density on the Baume scale is placed at zero. Consequently the Baume scale is an almost obsolete measure of density, and in order to get the exact density of any liquid, conversion tables are necessary if the Beaume hydrometer is used.

The different prepared emulsions put on the market are carefully made from oils of a definite gravity test in an emulsion carrying about the following proportions: 85 per cent. hydrocarbon oils (paraffin series), 4 per cent. phenols (mostly cresylic acid), and about 11 per cent. inert matter. These have proven to be very satisfactory in commercial use when diluted so that 20 and 16 gallons respectively make 200 gallons of spray, and seem to carry nearly correct physical characteristics to give proper penetration without injury to trees.

Both the crude and distillate oil emulsions contain the same ingredients as given above, the advantage of the distillate over the crude being mainly that for spring and summer use it dilutes more uniformly and can be sprayed on the trees with less danger of injury. The crude-oil emulsion is used chiefly as a dormant insecticide.

Now, in home manufacture, the orchardist can but follow certain cautious principles gleaned from the experience of those engaged in scientific manufacture, and so make the best of oils obtainable, such as kerosene, gas, lubricating, stove, and slop distillates, and crude oil. He will have to emulsify them by using ordinary whale-oil soap (olin acid) with common lye. Emulsions made from crude oil or slop distillates, in the writer's opinion, should be used only as dormant insecticide sprays. As such they are effective and fairly safe. Tested by Baume scale, they will run from 13 to 19 degrees, with a specific gravity of 0.9800 in crude oil to 0.9400 in the slop distillates. This, you will note, is not as good an oil as the commercial concerns put into their crude-oil emulsion, which is generally a natural crude oil, testing 23° Baume, and is not commonly obtainable in British Columbia. However, for purely winter use, a safe insecticide can be made from a 19-degree slop distillate by the following formula used successfully by Oregon State Experimental Station: Fish-oil or whale-oil soap, 5 lb.; lye, 1 lb.; crude oil, slop distillate, 6 gallons; water, 43 gallons; making a total of 50 gallons.

Close attention must be given to mixing. Water *never* should be added after the oil has been poured into the solution of soap and lye. Dissolve the soap in 8 to 10 gallons of boiling water and place in barrel or tank; add the rest of the water to make up 43 gallons. If using tank, start the agitator, add the lye, follow up with the oil, pouring the same slowly into the thoroughly stirred suds.

(NOTE.—This will not make a stock solution, which can be safely kept any time, so should be sprayed as made.)

Whenever a better oil or distillate is obtainable, I would not advise the use of the above crude oil, since often it contains so much foreign matter that it forms a poor emulsion and makes spraying more dangerous through non-uniformity of mixture. This crude emulsion should never be used except where it is possible to apply at least 200 lb. pressure with a good angle nozzle which throws a finely divided spray.

The chief advantage of the crude-oil emulsion is its apparent cheapness, but in reality the cost is about the same where a good stove distillate testing 29° Baume can be procured. Laid down in the Okanagan last year the costs were about as follows (to make up 200-gallon tank), F.O.B. Vernon: Slop distillate (crude oil), 19° Baume, 10 to 12 cents per gallon; fuel distillate (little better than stove), 35° Baume, 18 cents per gallon.

To make up 200-gallon tank requires: Crude oil, 24 gallons at 10 cents, $2.40; fuel distillate, 16 gallons at 18 cents, $2.88; kerosene, 12 gallons at 28 cents, $3.36; lime-sulphur, 20 gallons at 13 cents, $2.60.

(NOTE.—Kerosene used by ordinary formula would take approximately 12 gallons to make 200 of the dilute emulsion. Lime-sulphur for comparison only.)

In making the stove-distillate emulsions the same ingredients should be used, but both the amount of soap and the quantity of oil should be reduced. The following is satisfactory: Whale-oil, 4 lb.; lye. 1 lb.; distillate, 4 gallons; water, 45 gallons; total, 50 gallons. In the use of distillate, as in crude oil, do not add water after the oil has been poured in. In other respects follow the same rules.

There are several other interesting new sprays, such as the soda nitrate, used to stimulate growth and early development of fruit-buds, and powdered arsenates of lead to replace the ordinary paste. As a fungicide, atomic sulphur has proven very effective, and combines readily with both oil emulsions, soap solutions, Black Leaf 40, and arsenates of lead, therefore being more adapted to combination spraying than its predecessor, Bordeaux mixture.

Any of the above-mentioned spray materials could be studied separately, but time will not allow it here. Neither have I taken up the insects and diseases combated by the sprays mentioned, since they are known through study of more common sprays, which are all applied at the time most suited to kill or control the insect or disease in question.

THE TARNISHED PLANT-BUG (LYGUS PRATENSIS LINN.).

BY R. C. TREHERNE, FIELD OFFICER, DOMINION DIVISION OF ENTOMOLOGY, AGASSIZ, B.C.

In consideration of the comparative prevalence of fire-blight (*Bacillus amylovorous*) in various parts of the Okanagan District, I have thought it advisable to draw your attention to the fact that the disease is capable of being spread by means of several and sundry insects of the orchard. Mr. L. L. Palmer, Horticulturist, Coldstream Estate, at the meeting of this Society last July in Vernon, made mention of the fact that the several species of aphides are chief among the economic pests of the Okanagan. This is an important point, for it is clearly proven that aphides, and in particular the green apple-aphis (*A. pomi*), are capable of spreading the disease.

Naturally, then, the disease of fire-blight varies in extent in accordance with the prevalence of aphides, and the obvious control of the blight is accomplished, in

due proportion, to the control of the aphides. I cannot do better than draw your attention to the very excellent article written by Mr. Palmer and published in Bulletin No. 3, N.S., British Columbia Entomological Society, on "Some Problems of Aphis-control in the Okanagan."

Obviously, all insects that feed, more or less, on portions of plant-tissues or on plant-exudations affected by fire-blight are capable of transmitting the disease to healthy plants. Such insects, as numerous flies, wasps, bees, ants, bugs, borers, all effect their quota in transmitting the disease. Pruning alone may be practised with any degree of success against such visitants, which in very many cases are known to be a benefit to a tree rather than otherwise. The veterinary slogan "Remove the cause" may well apply.

There is one insect, the name of which heads this article, the tarnished plant-bug, which requires some attention. Mr. W. H. Brittain, who during the past summer held the position among you as Provincial Entomologist and Plant Pathologist, records this insect among his papers (printed in Bulletin 4, British Columbia Entomological Society) as noted "attacking a wide range of crops" in the Okanagan. "Probably," he states, "the most damage was done to nursery stock. Leaves that are attacked when young become wrinkled and curled. Sometimes small areas of the leaves become brown and die, subsequently dropping out and producing a 'shot-hole' effect. Blossom-buds attacked on fruit-trees are retarded in development, if not killed. Leaf-buds, when pierced at the base, frequently die and drop off."

In the same issue of our Proceedings (Bulletin No. 4) I have recorded this insect as being prevalent in the Lower Fraser Valley, and especially noted as a serious pest in greenhouses. Its presence is also noted in the orchards of the Lower Fraser Valley, although during the past two years I have not observed it as being especially destructive to fruit or blossom buds or to the leaves.

In view of the undoubted presence of this insect in our orchards, I beg leave to quote Professor Stewart, of the Cornell Experiment Station. In Bulletin 329, 1913, "it is believed that the most important agent in transmitting the 'blight' parasite to healthy trees has been the tarnished plant-bug (*Lygus pratensis*)." I would suggest, therefore, that those of you who are especially interested in the control of the fire-blight organism pay attention to the presence, prevalence, and control of this bug.

The adult belongs to the Heteroptera and to the family Capsidæ, or leaf-bugs. When fully mature the adult measures about 6 mm. long, and is shield-shaped in general outline, brown in colour, and marked with black, red, and yellow. There seems considerable variation in the colouring; some are inclined to be greenish or yellowy brown. The winter is passed in the adult stage beneath rubbish in the orchard or in such places as fence corners, clumps of leaf-mould, etc. Early in the spring, and possibly to some extent in the fall previous, oviposition commences. For a long period of time the season of the year and the place of oviposition have been in doubt, owing to the difficulty of successful breeding in captivity.

Within the past few years steps have been taken to more fully determine this point in the life-history, for obviously it is most important. In the *Journal of Economic Entomology*, 1908, Professor E. P. Taylor has recorded the fact that injuries to young developing fruit, "formerly classed as that caused by the plum or apple curculio, was instead the result of egg-punctures made by the tarnished plant-bug." Professor Taylor has not observed oviposition in apples at any time except in the very early spring immediately at or just after blossoming, and then particularly on the early-blooming varieties. Peculiar "dimples" are produced in the after-fruit, which outgrows the injury caused from the spring attack.

In 1910, Professors F. H. Chittenden and H. O. Marsh, in the same Journal, stated that they found eggs laid in the following places, viz.: (1.) April 19th—deposited on kale "slightly inserted on the upper side of the leaf." (2.) May 23rd—on volunteer turnips, deposited "in the seed-stalks, stems, and leaves, scattered about singly and in irregular rows or groups, sometimes three being placed close

together." Evidently eggs are "deposited chiefly in the stems, less seldom in the midribs, and occasionally in the leaves." (3.) On mullein—"eggs being inserted in the petiole or leaf-stem and in the midrib."

From these notes it would appear that oviposition in the early spring takes place in volunteer plants, weeds, and developing fruit. Yet a further reference is found in the *Journal of Economic Entomology* for 1913 by Professor Haseman, of Missouri. He believed that the bug "does not deposit its eggs in the tissues of plants, as some maintain, not even in the soft stems of weeds." He claims that the ovipositor is not strong enough to drill into the tissues of plants. In Missouri, he claims, the bug "deposits its eggs in the fall of the year at least, only in the blossoms of flowers such as daisies, asters, and particularly 'mare's-tail' (*Erigeron canadensis*)." Professor Haseman has further determined that the life-cycle may be completed in about a month.

We may judge, therefore, that, although this insect is among the commonest in our entomological fauna, there still remains a doubt as to its oviposition period. There seems little doubt that eggs are laid, as stated and observed, in the fall and in the spring, and for the most part in weeds. While the actual points of oviposition remain in doubt, yet it would seem that weeds act as the host-plants in the fall and in the spring; consequently the net value of these records to the farmer and fruit-grower remains the same. Destroy weeds.

In the spring, in due course, the eggs hatch to nymphs or immature stages of the bug. Probably four or five moults are undergone before the mature adult is formed. The adult, of course, sucks its food, and it possesses a long beak fully one-third the length of its body, which is folded beneath it when not in use. The adults are very active, darting off immediately they are disturbed. The only hope of capturing them is in the very early morning in spring, when they are partially dormant. They may then be shaken off the plants.

As Mr. Brittain noted last year, the chief injury at present is in the effect of the attack on the terminal shoots, and especially noted in nurseries. Peaches, pears, and apples are attacked, and no doubt also a variety of other plants, by the bugs, which suck the juices from the buds, causing a cessation of growth, followed by a twiggy formation or by a complete check. It may be noticed that there is a certain difference in the growth of the various varieties of fruit-tree growing under like conditions. Pear-trees develop most rapidly in midsummer; apples a little later. Furthermore, conditions of growth vary in accordance with climatic arrangements for the year, and induced growth at periodic intervals may be forced under artificial or irrigated conditions. All such conditions have an important place in our orchards, when it is realized that a succulent condition of growth is a determining factor in reference to the spread of fire-blight in certain varieties by such insects as the tarnished plant-bug. Given a succulent growth, the presence of *L. pratensis*, and the blight organism, it will be noted that the attack will be more severe than on a growth hardening up or previous to sap activity with the same two agents present.

For control measures may be recommended the destruction of all weeds and the cleaning-up of fence corners in the orchard. The trapping by sticky shield or by beating in the early morning and the application of kerosene emulsion in dilute form to the leaves at the time when nymphs are present. Sprays of dilute nicotine extracts may also be used, applications in this form being applied about every ten days, especially under greenhouse conditions.

THE PART PLAYED BY INSECTS IN THE SPREAD OF PLANT-DISEASES.

BY J. W. EASTHAM, PROVINCIAL PLANT PATHOLOGIST, VERNON, B.C.

Plant-diseases are of two kinds. In the first place, we have the so-called physiological or non-parasitic ones, which are due to some irregularity or disturbance in the processes going on in the plant and induced by external conditions, such as deficiency or excess of certain chemical substances in the soil, too much water,

rapid change of temperature, etc. On the other hand, we have diseases directly due to a parasitic organism obtaining an entrance into the tissues of the plant, and growing there, bringing about malformation or death of the attacked parts. Obviously, insects can only be concerned in the spread of diseases of this type when an organism or "germ" can be conveyed from one plant to another. Disease-producing organism are of two kinds, fungi and bacteria. While both of these are for the most part microscopic, they are nevertheless very different in their relative size. A fungus often forms a "body" or mycelium of considerable extent, while bacteria are always exceedingly minute, and their destructive action depends upon their rapid multiplication, large masses of individuals being soon formed.

Fungous diseases are not usually directly spread by insects, although the spores may be carried about and distributed to some extent by their agency. Usually a parasitic fungus produces quantities of spores which are most effectively distributed by wind and rain. To produce infection, however, these spores must have sufficient moisture to enable them to germinate, and the germ-tube so produced has either to dissolve its way through a very resistant membrane, the cuticle of a plant, or to grow along until it finds some natural opening like a stoma or a place where the cuticle has been broken. It is in this latter respect that insects may greatly favour infection. It is probable that the flea-beetle in this way aids the spread of the early blight of the potato and tomato due to *Macrosporium solani*. Perhaps the best instance, however, is the spread of the brown-rot (*Sclerotinia fructigena*) in plum and peach orchards in the East through the agency of the plum-curculio (*Conotrachelus nenuphar*). The punctures made by this insect result in an exudation of gum which affords an excellent situation for the development of the spores of the fungus, which, moreover, are often carried and introduced into the wounds by the insects. The control of the plum-curculio has hence been found to be essential in the control of brown-rot in the East.

In the case of bacteria we find that these organisms have usually no power of penetrating the cuticle of a plant. They are for the most part dependent for an entrance on natural openings or injuries, except when the tissues are exceedingly delicate and without cuticle, as in the nectaries of flowers, root-hairs, and perhaps the young growing tips of shoots. They also do not produce externally anything corresponding to the spores of a fungus, but live internally in the host-plant. Hence the role of insects as agents in the distribution of such disease is much more important.

A very good example is the wilt disease of Curcubita, which attacks cucumbers, muskmelons, pumpkins, or squashes. This is caused by *Bacillus tracheiphilus*, which develops in the sap-vessels of infected plants to such an extent that the vessels are completely plugged up for long distances. Later the walls of the vessels are destroyed and the conducting system broken down. As a consequence the whole of the plant above the infected vessels wilts and dies. So far as is known, natural infection can only take place through insects feeding on an infected plant, getting their mouth-parts smeared with bacteria and then biting into a healthy plant. The two insects mostly held responsible are the striped cucumber-beetles, *Diabrotica vittata* and *D. 12-punctata*. The chief gap in our knowledge of the life-history of the disease is with regard to the way in which the organism passes the winter. Probably the remains of attacked plants in some cases retain bacteria in a living condition over the winter, and the first infections of the season may be, so to speak, more or less accidental. I do not know that either this disease or its insect carriers are found in this Province, but the disease is known in Nebraska and Colorado, and the insects, I believe, have been found in Washington, so it is quite likely we shall ultimately have to deal with this disease.

A disease which comes nearer home to most of us, and in the distribution of which insects play an exceedingly important part, is the fire-blight of apple, pear, and quince. So far as we know, the first infections of the season are always produced by insect infection of the blossoms. The exudate from hold-over cankers

serves to contaminate the insects which come to feed on it, and if such an insect visits a blossom within a short time after, the honey-glands of the latter are likely to become infected. The nature of the insects visiting these running cankers affords scope for much further observation. Probably many kinds of flies may serve to carry the disease. Wasps have also been rather frequently recorded as visiting the cankers, but I am not sure that these insects are very common visitors of orchard blossoms. Chiefly on the strength of the observations of M. B. Waite, of the United States Department of Agriculture, the honey-bee has been put down as a carrier of the first infection, but I have been able to find very few other trustworthy observations of honey-bees visiting the cankers. We also know that many moths are strongly attracted by sticky, sweet substances, and that the "sugaring" method is a common one with entomologists for collecting night-flying Lepidoptera, and I think it is quite possible that these insects may play a part in disseminating fire-blight. There are, of course, rather grave practical difficulties in the way of securing proper data on these points. In the first place, it would be necessary to have running cankers under observation, both night and day, for some time. Such cankers would also have to be freely exposed, and in a region where fire-blight offers such difficulties in the way of its control an experiment of this kind would not be likely to be viewed with much favour by neighbouring orchardists. We should be very glad, however, to receive specimens of any insects which may happen to be found on running cankers about blossoming-time.

A question sometimes asked is whether the blight bacillus can live through the winter season in the hive or nest of the bee. If so, it is conceivable that bees might become contaminated with the germs and carry the infection to the flowers during their honey-collecting trips in the spring. So far as the honey is concerned, there would seem to be very little danger. Nectar, it is true, affords a medium suitable to the rapid multiplication of the blight bacillus, but the nectar of a flower is different in composition from the stored honey. Such examinations as have been made of comb-honey have shown it to be almost uniformly sterile.

It is at the same time worthy of note that germs of a rather remarkable nature can be isolated from the intestine of the honey-bee. Dr. Franklin White states that he has thus isolated the colon bacillus and that of hog-cholera. Whether the fire-blight bacillus could exist for any length of time in the intestinal tract of the bee or not, I do not know for certain, and I do not know of any work on this phase of the subject. I should think, however, it would be very unlikely. In the first place, the germ is not a spore-former, and has therefore only very limited powers of resistance to unfavourable conditions; and, secondly, being adapted for plant-parasitism, the conditions of temperature, oxygen supply, etc., in the intestines would probably be very unsuitable. The same objections would probably apply in a less degree to the possibility of the germs wintering over elsewhere in the hive.

Once the disease has been introduced into the first blossoms, there is no doubt that subsequent blossom-infection results from bees visiting such infected blossoms, becoming smeared with the germs and then leaving them behind in the healthy flowers visited. The number of flowers which may be infected in this way after one visit to an infected flower is probably very large, although I have no data. Surprise is often expressed that so many blossoms on a tree should show the blight almost simultaneously. Considering, however, the method by which it is spread, a very few contaminated insects would be sufficient to explain this.

It is sometimes stated that blossoms may show the effect of blight before they have opened. In this connection it is to be noted that there is liability of confusion between the effects of blight and of certain insects—e.g., tarnished plant-bug. On the other hand, it is quite possible that some small insects may visit cankers and afterwards creep into unopened blossom-buds. More observation is required in this connection.

A question of practical importance is whether there is any relation between the number of bees kept and the prevalence of blight. In some parts of the

Okanagan the part played by bees in distributing the disease has so seized upon the minds of the growers that any person setting up an apiary is regarded with considerable disfavour by the rest of the community. Now, I do not know that any one has ever noticed a correlation between the number of bees kept and the prevalence of blight. From what has been previously said, it will also be seen that a very few bees may be as effective in spreading the disease as a large number. However, if many bees are kept and there is a scarcity of flowers in early spring, it is possible they might be more attracted to running cankers and thus produce more primary blossom-infection. On the other hand, proper setting of the fruit is largely dependent on bees, and in the districts mentioned there are some indications of defective pollination. On the whole, it would be much better policy to make every possible effort to clean out hold-over cankers rather than place bee-keeping under a ban, as in any case it will not be possible to control or exterminate wild bees.

In the spread of the disease later in the season several insects are implicated, the tarnished plant-bug, aphides, and leaf-hoppers being probably the worst offenders in this part of the country. In Ontario the bark beetle (*Scolytus rugulosus*) has been shown to be a very potent agent in disseminating fire-blight in the pear. If a pear-tree is suffering from attacks of both blight and bark-beetles, there is great danger of the beetles leaving such a tree and boring into healthy adjacent trees, and thus communicating blight, which is often "body-blight" and rapidly fatal to the tree.

D. H. Jones records a case where a pear-tree infected with body-blight was cut down but not removed. The beetles migrated from this tree into two rows of young pear-trees adjoining, with the result that 60 per cent. of these became attacked, a beetle being found in every blight area. This beetle has not, I believe, been yet discovered in British Columbia, but beetles of similar habits occur and such infections may be considered possible.

The extent of the danger resulting from leaving the blight-cuttings under the tree instead of at once removing and burning them is a matter of practical importance. While the danger may not usually be great, it may become considerable under certain conditions. I have seen fresh cuttings of blight-infected twigs lying on the ground and swarms of ants running over and amongst them and then up the trees. Aphides were present on the twigs of the trees, and ants are very prone to mingle with aphides on account of the honey-dew they excrete. If fresh exudate had been present on the blight-cutting, we should have had all conditions present for reinfection of the trees. At the time the weather was hot and dry and moist exudate was not observed, thus reducing the chances of infection under the circumstances to a minimum.

PART II.

BRITISH COLUMBIA ENTOMOLOGICAL SOCIETY.

PROCEEDINGS, 1915.

THE Fourteenth Annual Meeting of the Entomological Society of British Columbia was held in the Auditorium of the Aberdeen School, Vancouver, B.C., on January 16th, 1915. The meeting was called to order by the President, G. O. Day, F.E.S., of Duncan, B.C., at 10 a.m. on January 16th. The day was divided into morning, afternoon, and evening sessions.

Mr. Day (President): It is only right that the meetings should be held in different places, and this year it has come to Vancouver, and I hope that there will be a large number of members present, and also that in the course of time this Society will come to Duncan. We just want to start the meeting by discussing a little business. I hope Mr. Treherne will tell us what we shall have brought forward.

Mr. R. C. Treherne: There are several points I would like to bring up before the meeting in order to get things started. There is a resolution I would like to place before you: "That the following names of individuals and institutions be added to our complimentary mailing-list; that is to say, in addition to those that have already been printed in Bulletin No. 4: Library of the University of British Columbia, Vancouver, B.C.; Library Department of Education, Victoria, B.C.; Dr. Matheson, Division of Entomology, Cornell, Ithaca, N.Y.; Library, McGill University, Montreal, Que.; Library, University of Minnesota, St. Paul, Minn.; American Entomological Society, Logan Square, Philadelphia, Pa.; Geo. Moznette, Division of Entomology, Corvallis, Oregon; E. O. Essig, Division of Entomology, Berkeley University, Cal.; Agricultural Gazette, Publication Branch, Department of Agriculture, Ottawa, Ontario; Library, University of Illinois, Urbana, Ill.; Edmund Jarvis, Division of Entomology, Brisbane, Australia; Laboratorio di zoologia general & agraria, Portici, Napoli, Italy."

Most of these people and institutions have written for our bulletins, and I think it speaks very well for our Society to receive requests from Australia and Italy. I think it speaks well for the progress we are making. I will just put this in the form of a resolution that these be added to our complimentary mailing-list; also Barnes & McDonough, Decatur, Illinois.

Mr. Blackmore: I suppose our friend Mr. L. W. Swett, 501 Washington Street, Boston, Mass., is on the list.

Mr. Anderson: Of course you have the Columbia University, Barnard College, New York, N.Y. It should be in the resolution that these names be added to our mailing-list.

Mr. Tom Wilson: I second it.

Resolution carried.

Mr. Treherne: At the present time I have the following members to be added to our membership: Mr. Howitt, Prince Rupert, B.C.; Mr. Hook, Cobble Hill, B.C.; Rev. Canon Hinchcliff, Chilliwack, B.C.; Mr. Geo. Raley, Chilliwack, B.C.; Miss E. Warren, Barnston Island, B.C.; Mr. Henry Bailey, South Hastings, B.C.; Messrs. A. E. Baggs, T. A. Hamilton, C. W. Mathers, M. G. Stevens, C. L. Thornber, and T. Williams.

Mr. Day: Have you had a request from Miss Sellence, of Duncan, B.C.?

Mr. Treherne: I do not believe I have.

Mr. T. Wilson: I move that they be made members.

Mr. Day: I second it.

Resolution carried.

Mr. Treherne: There is another matter I would like to have put in our proceedings, as a feeling of regret that one of our members, Dr. de Yerteuil, was drowned off H.M.S. "Good Hope" off the Chilean Coast. He was a member of this Society and well known in Vancouver. He went to the war as a naval surgeon.

Mr. Day: I think it would be nice to send a copy of this resolution to his relatives if they could be found.

Mr. Treherne: There is another point I would like to bring up in connection with the war. I have received a letter this morning which is an example of several I have received. This is from a member at Creston. He states as follows:—

"Owing to my departure to the war in the very near future, there will be no sense for the time in renewing my connection with this Society. However, wishing it every success in future as it has had in the past,

"I remain,

"H. S. FITZGERALD."

There are one or two other men who have gone to the front who have not forwarded their dues but wish to retain their membership. I propose, therefore, that we should send their 50 cents out of the funds of our Society to the Ontario Society to retain their connection, so that they will receive their bulletins.

Mr. Day: I do not think we can do anything less; it is nothing but right.

Mr. Treherne: With reference to the resolution we passed this time last year in connection with the buying of insects from the members of our Society, I took this matter up with the University Council, having in mind that Mr. Cockle would probably have a fine collection of insects to dispose of, and I have received the following reply from Dr. Wesbrook:—

"Last night I brought your letter regarding the collection of insects before the Board of Governors. The Board would be very glad, if at any time collections are available, if we might be informed, although as yet we shall exercise great care in securing collections until such time as the Department is manned, so that we will have the benefit of the judgment of its head and his staff."

Mr. Blackmore: Are there any collections on the market?

Mr. Treherne: Yes.

Mr. Day: They have not yet started their building, so are not in a position to make any offer.

Mr. Treherne: There is another letter which I received which I have not got here. It is from Saskatchewan from Mr. Johnston, of the Saskatoon High School, and he states that he has noticed the proceedings of our Society and has been much interested, and has been moved to frame up an Entomological Society for Saskatoon. The proceedings of their Society, which they formed a couple of years ago, has been printed in a local newspaper. They have now approached the Government, and they are going to give them this spring a small grant, very much like what we are getting, and they are proposing to publish their proceedings. This is very interesting.

There is another point that I have taken up privately, although I understand it was taken up, more or less, as a Society matter in the East. The annual meeting

of the Ontario Society was held last November, and in order to publish it in time for this meeting I wrote a personal resolution in my own name, suggesting that all of these Provincial Societies should be boiled down, and that we should no longer try to enlarge the scope of the proceedings of British Columbia, Quebec, or Nova Scotia. I made mention that we were a branch of the National Society, which had become known as the Ontario Society. I suggested that the publications of proceedings be amalgamated and formed into a bi-monthly national bulletin. Furthermore, we have from time to time practically taken from the *Canadian Entomologist* papers that were offered to us because they were British Columbia subjects, advising us that if we did not want them they would send them to the *Canadian Entomologist*. This is undesirable. If we form a National Society we may get a bi-monthly bulletin. These proceedings (Bulletin 4) were given in January last and came out last September, being eight months before they got to the public. It would be much better to have a National Society and have them published quarterly.

I suggested in my resolution that the Dominion Entomologist be requested to approach the various Provincial Governments, asking for a separate grant from each proportionate to the membership, and to establish headquarters in Ottawa or some other place from which the bulletins can be issued. This was taken up, I fear, as coming from this Society. However, if this Society desires to go on record——

Mr. Day: I think we should have an opinion from the private members; it is a matter that requires thinking about.

Mr. Treherne: I have also been informed that Dr. Bethune and Dr. Walker, of Ontario, are considering the matter.

Mr. Anderson: Has the private opinion of the other Provincial Societies yet been aired?

Mr. Treherne: Not yet; in the meantime their replies are still pending. I wrote Mr. Brittain in Nova Scotia suggesting that he get busy along the same lines.

Mr. Treherne: It is an expensive proposition getting out bulletins like this. We have to get our own plates and pay for them ourselves, and if we could only get a National Society together we could use a great many plates which are in the East.

Mr. Day: Would the proceedings of the National Society be extensive enough to include all such proceedings as are now published by the Provincial Society? Would they not eliminate a great deal? That would be a point we would have no control of, what they will print or will not print; whereas if we publish our own proceedings we can print what we want and use our own discretion. They will leave out a lot of things which we would like to have put in.

Mr. Treherne: I suppose the committee would be representative of the different Societies. I fancy there should not be any difficulty from that, because the number of issues published in the year would greatly exceed the supply. Say here we have 80 pages in this bulletin, and the Ontario Society is not much larger than that. If we split it in four and spread it over a year it would cover all.

Mr. Anderson: All details sent in from each Society should be printed?

Mr. Treherne: If we had an Advisory Board, it would rest with them as to what should be printed.

Mr. Day: It is an important question, and perhaps we ought to take the opinion of this Society, and in the meantime ascertain the feeling of the other Societies and lay it over for another year.

Mr. Treherne: It appears to me that it is only a question of time and it will have to come down to this bi-monthly proposition. This annual report business seems to me to be absolutely antiquated. Each one is trying to publish a little bulletin of its own Society, while they really all should come under one head. That is my point. One Society is in competition with the other, and competition is always wasteful. If you care to leave this over until this evening or lay it over for another year, we can think it over.

Mr. Day: I think Mr. Treherne should be commended for what he has done; he has taken a very important step.

Mr. Treherne: I think it was taken up wrongly by the East as coming from this Society as a resolution passed at our last annual meeting.

FINANCES.

Mr. Treherne: The finances of this Society at the present time are in excellent shape. We received a Provincial grant of $350 last April. The Minister of Agriculture has for the last two years allowed us $250 each year. When writing him last spring I asked him for this grant of $250, and informed him that we were $100 odd in the hole, and he very kindly remitted us the grant of $250 plus $100, which more than covers the deficiency, so now at the present time our accounts have already been certified O.K., and the balance in the bank at the present time is $183.30, and $34 has been received in fees, and half of $34 would be $17, which added to the $183.10 will give us the total sum we have in the bank. An account of the finances to date is published in Bulletin No. 5.

As a matter of form, I wrote to the Minister of Agriculture again and requested him for another further grant this year. I received a letter from Mr. Ellison in which he stated:—

"I note your request for a grant of $250 this year as previously. In reply, would say that I shall endeavour to get this grant passed in the estimates, although I cannot say whether it will go through."

I also wrote to Mr. Scott, Deputy Minister of Agriculture, and he replied:—

"Adverting to your letter of the 28th, I take pleasure in advising you that the Honourable Minister of Agriculture has authorized me to place the sum of $250 on the estimates for your Society. This will accordingly be done, and provided it is passed by the Executive, will be payable at the beginning of the ensuing year for the work of your Society."

I do not think there is anything else to bring up.

The President: I think the next business will be the reading of the papers. The first one is: "(*a*) Aphid Notes from British Columbia; (*b*) *Myzaphis (Aphis) abietina* (the Green Spruce-aphis)," by H. F. Wilson, Corvallis, Oregon.

Mr. Treherne: This is a paper Mr. Wilson wrote for our Society regarding his experiences when he was up here the summer before last. We are getting out a little bulletin which will be Bulletin No. 5, and this paper will be given there. It refers to the green spruce-aphis, which is doing more damage than any other insect on the Coast at the present time. It is a periodical visitant. This bulletin will be published in about ten days, so that I do not think it is necessary to take this matter up before the Society.

Afternoon Session.

The President: The first paper this afternoon is on "Insects of the Greenhouse," by G. E. Wilkerson, Victoria, B.C.

Mr. Treherne: Mr. Wilkerson had to return to Victoria this afternoon, so handed in his paper to be read.

INSECT PESTS IN GREENHOUSES.

BY G. E. WILKERSON, VICTORIA, B.C.

In dealing with this subject I will endeavour to give a short description of the different pests, and to go more fully into the damage that they do and how their presence may be detected, and the best way to eradicate them, or, at least, keep them in check. This I will give from my own personal experience in greenhouse work for the last twenty years in Victoria. I will endeavour to give only such descriptions as any person connected with greenhouses can understand.

GREENHOUSE THRIPS.

The first pests I will deal with are greenhouse thrips. The best description I can give is that taken from Bulletin, Volume 11, Nos. 1 and 2, of the "Monthly Bulletin of Injurious and Beneficial Insects of California," by E. O. Essig, which is as follows:—

General Appearance.—The adult insect is characterized by having the antennæ eight-segmented and twice as long as the head, while the surface of the body is distinctly reticulated. The abdomen is yellowish-brown, with head and thorax dark brown, and antennæ, legs, and wings colourless.

Life-history.—The very minute, bean-shaped, colourless eggs are inserted in the leaf-tissues of food-plants, usually on the under-side. They hatch in about ten days. Each female lays from ten to twenty eggs. The first hatched larvæ are colourless, with seven-segmented antennæ. As they age they become darker in colour and the antennæ become eight-articulated. The larval and pupal stages occupy from four to six weeks. All stages feed throughout their life-cycles. There are continuous and overlapping generations, estimated by H. M. Russell to be twelve a year.

Food-plants.—Food-plants are, with very few exceptions, all plants grown in greenhouses. My reason for dealing with Thrips first and giving them the most prominent place in this paper is because I consider that they do as much, if not more, damage than all the other pests combined, and are by far the hardest to control around Victoria District, but they cause most loss in carnations.

The grower may not suspect their presence until one-third, or I have known one-half of his crop ruined by this pest. The first indication he will notice of the presence of Thrips will be that the edge of the petals of the blossom is discoloured, having a dried or burnt appearance on the light-coloured flowers, and the red and crimson ones will have white spots on them. Now, by carefully pulling the flowers apart, there will be found from one to a dozen of these pests working very industriously.

Control.—This is a very difficult matter, as I am satisfied that Thrips work very little among the carnation-foliage, but lay their eggs and are hatched out in the bud of the carnation, and during this time they are almost hermetically sealed in the tight folds of the carnation-bud, so I consider spraying of very little value; at least, that is what I have found. I have tried heavy fumigating with red pepper and tobacco-stems to be of considerable value, but the best remedy, at least the one we have most success with, is fumigating with nico-fume, or Black Leaf 40. This is best applied by painting the return pipes and turning on the steam; as soon as this has been done, taking care that all ventilators are tightly closed. If the grower does not heat by steam, he can get the same results from hot water, providing he can heat the pipes to a temperature of not less than 190° Fahr., and more, if possible. Failing this method, the next best way is to vaporize the nicotine solution over a spirit or coal-oil lamp. The quantity of nicotine solution to use depends on the size of the house to be fumigated, but full directions are given on the tins containing these solutions, and I have found these directions very satisfactory.

By keeping the temperature of the houses in as moist a condition as can be done with safety, and by frequent syringing, it will have a strong tendency to keep these pests in check, as they do not like moisture. This can be done with comparative safety during the months of July, August, September, and the first two weeks in October in this district, these being the months in which the most damage is done by Thrips; after this time they practically disappear until the following season. A great help is to keep the greenhouse perfectly clean, allowing no rubbish, dead flowers, etc., to be around on the paths or on and under the benches.

Some growers use ⅓ to ½ oz. of potassium cyanide and 3 oz. of sulphuric acid, C.P., dissolved in 4 oz. of water; but, personally, I do not like this method, as it is dangerous unless very carefully handled, and the results are sometimes very disastrous to the plants. I have found when using cyanide that one time you get

apparently satisfactory results, with little or no damage done to the plants, and the next time I used it, although using exactly the same quantity, there was a large amount of damage done; this, I believe, is caused by a possible difference of temperature and humidity in the atmosphere of the houses.

The damage caused by Thrips on roses is similar to that on carnations, as they attack the rose-buds almost in the same manner, and the same treatment is applicable.

The procedure of attack on chrysanthemums is considerably different. When attacked, plants show on the tips of the leaves a slightly yellowish appearance, also a thickening of the young leaves. On the tips of the plants, upon close examination, numbers of the insects will be found on the under-side and sometimes on the top side of the leaves. To destroy these, spraying can be done, as, different from the carnation or rose, you can reach them with the spraying material. I have found that the nicotine solutions before mentioned, with a little soap added, to be very satisfactory, also the whale-oil soap and quassia-chips do very good work.

Take 1 lb. of quassia-chips and 8 oz. of whale-oil soap; boil together for one hour in 1 gallon of water, then strain. Make up evaporation caused by boiling so that you have 1 gallon of the liquid. When using, add twelve parts of water. This is a very economical and efficient spray.

Thrips attack most of the commercial pot-plants that are grown in greenhouses, such as gloxinia, cyclamen, fuchsia, etc.; but if taken in time, spraying or dipping in the before-mentioned remedies will be found efficient.

RED SPIDER.

This insect, I consider, is next in line as causing most loss and damage in the greenhouse.

General Appearance.—They are exceedingly small and individuals are seldom noticed. Their colour is red with a yellowish tinge, and usually with two darker spots on each side of the body. Their appearance will first be noticed by the leaves of the plants having a pale and unnatural green colour, and upon examining the under-side of the leaves there will be found numbers of these insects. It attacks nearly all plants grown under glass.

Control.—This pest, fortunately, is easily destroyed and kept under control. All that is required is heavy but careful syringing by water, but it is very necessary that the under-side of the leaves must be syringed, and there is no excuse for any grower who possesses a good water-supply to receive much loss from the depredations of this insect, although, if not kept in check, red spider will cause the loss of the whole crop of chrysanthemums and other plants.

Sometimes during the middle of winter, when it is unsafe to syringe carnations and roses very heavily, red spider will get a foothold, especially those plants close to the heating-pipes, but just as soon as the days lengthen and we get more sunshine, syringing can be resumed and little damage will have resulted, providing that the plants have been kept clean from this pest previous to such time when syringing had to be discontinued on account of weather conditions.

GREEN APHIS.

This insect hardly needs any description, as it is so commonly known. It attacks practically all plants grown under glass, and if not destroyed or kept in check will do a lot of damage; in fact, it will ruin any crop that it attacks unless means are taken to destroy them. Fortunately they are the easiest of all insects to kill.

I have found that any of the before-mentioned nicotine solutions will destroy them, used either as a spray or vaporized. The whale-oil soap and quassia-chips are also very effective, but vaporizing is the best method, as by that means you kill all of the young aphides, when by spraying you only kill those that come in contact with the spray.

Green aphis is active all the year round, but more particularly so from April to November. The best way to keep it down is by frequent fumigating and spraying, so as not to let it get a strong hold. If the greenhouses are fumigated regularly every week or ten days, little trouble will be experienced from this pest.

BLACK APHIS.

This insect is similar to the green aphis, excepting in colour, but does not attack as many varieties of plants. In fact, I have found that the only serious attack has been on chrysanthemums, and the same remedies as advised for green aphis will do for the black aphis. In fact, I have found it easier to exterminate than the green aphis.

WHITE FLY.

This is the common name that this insect is known by in the Victoria District, but from the same authority as quoted *re* Thrips, I do not think I can give a better description, which is as follows:—

General Appearance.—The adult white flies are about $^{3}/_{50}$ inch long, the males being slightly smaller than the females. The bodies are yellow and the wings pure white. The eggs are exceedingly small, oblong in shape, at first light green, growing black with age and attached by a short stipes. The larvæ are light in colour, transforming to flat pupæ about $^{3}/_{100}$ inch long; oblong oval in shape; light green and supporting noticeable wax-like rods or spines, which make this species readily distinguishable from all others.

Life-history.—The eggs are laid upon the leaves of the plants, each female depositing over one hundred. These hatch in about two weeks into larvæ, which begin feeding very shortly, and after three moults, covering nearly a week, they become pupæ, which after two more weeks are ready to emerge from the old pupal skins as adult insects. The adult feed constantly throughout their existence of some thirty days.

Food-plants.—Tomatoes and cucumbers seem to suffer most from the attacks of this pest, though a large number of other plants are infested, including the bean, egg-plant, melon, lettuce, grape-leaves, aster, chrysanthemum, salvia, lantana, fuchsia, rose, coleus, geranium, primrose, ageratum, etc.

This insect, I have reason to think, was imported into this district some eight years ago. That is when it first came to my notice. I think it must have been brought in on plants imported from Eastern Canada and the Eastern States, as previous to seeing them here I had noticed their presence mentioned in the different trade papers, and inquiries made about them and as to the best way to combat them. In this district they are most troublesome to the tomato-grower, and I have known instances when the plants have been infested with thousands of them. Some growers use the Gerod process of fumigating to destroy them, but, unfortunately, I have known as much injury, if not more, has been done by this than what the insect would do. So far, I have found the best method is to fumigate with the nicotine solution as soon as the pest is noticed. By this means we have been able to keep it in check sufficiently, so that our loss has been very slight, but we take great care that all plants, after the crop has been gathered, are burnt up.

If the grower, after his crop is gathered, and the plants burned and the greenhouse is empty of all other plants, I believe that it would be a good plan to fumigate with potassium cyanide, but care must be exercised that the walls between the house fumigated and the adjoining house are tight—that is, if the houses are adjoining—and as a matter of precaution the adjoining houses should have their ventilators left open while the affected house is being fumigated. I think that the resin spray, as recommended by the Provincial Board of Horticulture, as a summer spray, should prove of value in fighting this insect, and if we are troubled with it very much this season I intend to try it.

CUTWORMS.

These cause considerable loss, especially in chrysanthemums, but as soon as their presence is noticed they can be easily eradicated and destroyed by the use of poison bran. Take a pail of bran and thoroughly mix in about 1 to 1½ oz. of Paris green, then moisten with sweetened water and spread on the ground and on the benches on which the plants are attacked, and in the course of a day or two these pests will have disappeared.

In this paper I have not dealt with all the insect pests that cause loss to the grower of plants, etc., under glass, but have dealt with the most important which trouble us in this district.

In conclusion, I would strongly impress upon the grower to keep a close watch at all times for any signs of attack, and at once use the remedies recommended. Do not consider the expense of purchasing the different sprays, as you will lose ten times the amount that these will cost by allowing your plants to be overrun.

I would like to call the attention of this Society to the advisability of approaching the Dominion Government regarding the removal of duty on all nicotine solutions, such as nicoticide, nicotine, nico-fume, Black Leaf 40, etc. As far as I know, they are not manufactured in Canada, or likely to be so. Now, as these preparations are only used for the extermination of the natural enemies of the growers, I consider it would be a good policy to enable the grower to procure these at the least possible expense.

Mr. Day: Any questions you would like to ask about this paper? Mr. Treherne will be pleased to give you any explanations he can.

Question: What is the best way to destroy insects that get down into the root of the cabbage?

Mr. Treherne: That is a fly known as the cabbage-maggot, and it is a little white grub at the root of the cabbage. It is the worst insect found in truck-gardens, as it is believed to destroy 75 per cent. of the cabbages in this part of the world. The best remedy against it is to get a piece of tar-paper and insert around the plant on the surface of the ground.

Question: I tried it last year, but it did not have any effect.

Mr. Treherne: Perhaps your paper was too light; if it is not heavy enough it will curl with the sun. Under experimental work we have had 90 per cent. efficiency during the last two years with this same method. There is a solution you can use; carbolic acid and soap mixed into a solution and dilute it 1 to 15 and pour about 5 oz. around each plant once a week during the early part of the season, and it will take about eight applications, but this solution will not give you as good results as the tar-paper.

Mr. T. Wilson: Talking about this same thing, I was talking to a gentleman at Chilliwack, and he had tried both methods with a good deal of success. He used this carbolic solution which I had told him about and he added so much arsenate of lead, and before planting he dipped the roots into this solution and he had 80 per cent. success.

Mr. Lyne: I believe that arsenate of lead diluted at the rate of 2 lb. to 50 gallons of water would not be injurious to the plant, and would be a sufficient quantity to stay on the plant; and if it did it would be perfectly impossible for the larvæ to consume any of the plant.

Question: I would like to hear more about the tar-paper.

Mr. Treherne: Do you know how it works? You make a disk of the tar-paper about 3 inches diameter with a slit in the centre, and as you put your plant in the ground you place this disk flush to the surface of the ground around the neck of the plant. The idea is that if the tar-paper is fresh it will keep the fly away; and if it does not, the eggs will be laid on the surface and often perish.

Question: How long do these plants have to be protected before the maggots cease to act?

Mr. Treherne: The fly will be laying eggs until September, but probably the plant will be so well established by the middle of July that further control against it would not be of practical value.

The President: I will now call on Mr. F. H. Getchell, Vancouver, B.C., for his paper on "Insects of the Lower Fraser Valley."

NOTES ON SOME INSECTS OF THE LOWER FRASER VALLEY.

BY F. H. GETCHELL, FIELD INSPECTOR, PROVINCIAL DEPARTMENT OF FRUIT PESTS.

During the past three seasons I have had the opportunity of collecting a few notes on the habits of insects frequenting the orchards of the Lower Fraser Valley. Through the courtesy of my Department I am permitted to give the Society a record of some of the notes obtained under their authorization. Many of the insects I have recorded in my notes have already been well reported in an article by Mr. Treherne in Bulletin 4 of the British Columbia Entomological series, and consequently it will not be necessary to deal at any length with any one individual insect. I have, however, several notes of local importance which may well supplement the facts already recorded.

THE WOOLLY APHIS (*Eriosoma lanigera*).

This insect is found in nearly every orchard in the valley. During the past season I have spent considerable time both in spraying and investigating this insect in the orchard owned by J. H. Lawrence, Hatzic, which numbered 2,500 trees from four to seven years old. Upon my first inspection I found one corner of the orchard, consisting of about 300 trees, seven-year-olds, badly infested with woolly aphis; the old stem mothers and the young brown aphides having, for the most part, wintered over on the trees. As a result of their work the small limbs and spurs were split and covered with the usual galls. A spray of Black Leaf 40, 1-800, and ordinary soap, 2-50, was applied, combined with lime-sulphur. In another set of experiments the lime-sulphur was replaced by soluble sulphur, a new spraying compound freshly come on to the market in these parts. The Government Bean power-sprayer, with Friend nozzles, was used at a pressure of 200 lb., and at a moderate estimate 75 per cent. of the aphides were killed at the first spraying. Although it is perhaps a trifle premature to make any definite statements about the relative virtues of the two sprays, lime-sulphur and soluble sulphur, yet I may say that, from this past summer's experiments, I have so far seen no difference in the effective values.

Twice during the summer they were treated by hand with coal-oil, once immediately after spraying. They were again sprayed with the machine the second week in August, with Black Leaf 40 from 1-800 to 1-1,000, and whale-oil soap 2-50. During this spraying I found it necessary to leave the district temporarily, but in a week's time I took the work up again. I soon discovered the aphides were migrating to a greater extent than I have ever observed before, and some of the older forms were dying. The date was the first week in September.

Later I observed a few of the migrants settled on the main bodies of the pear-trees in the neighbouring orchards. This is in itself an interesting observation, but I noted, further, that pear-trees as late as October still contained specimens of woolly aphides on them. These aphides were observed to be quite active when not even disturbed. I judged that, as the species does not habitually frequent the pear, they were ill at ease. Besides the movement to the pear, I noticed that a migration also took place to apple-trees where apparently the aphides localized and would remain there until the following year. I have no doubt, further, that many of the migrants, in searching for suitable trees on which to settle, failed to locate, and

thus many were lost; furthermore, I have no doubt also that a percentage of the brood did not move at all, but remained on the same trees as they were on during the summer. However, the migration as a whole was most marked, as I observed before.

Two apple-trees were so covered with aphides in September that in appearance they resembled snow. These trees were sprayed with Black Leaf 40 and whale-oil soap. This spray was very effective, as no aphides were found to survive.

THE PEAR-LEAF BLISTER-MITE (*Eriopyes pyri*).

This insect, which I have found in some orchards at Mission, had destroyed all the fruit. It is not necessary to mention the damage to the foliage, as this injury is well known. The former observation is, of course, the most important. A little infection occurs in every orchard visited in the valley, which indicates that it is spread throughout the whole valley.

THE BUD-MOTH (*Tmetocera ocellana*).

This insect is steadily increasing in the valley. Some orchardists believe it thins out the fruit on the tree; consequently they believe it a benefit rather than a detriment. The fallacy of this view I need not expose. While spraying the past season I found it working on the opening buds and blossoms the first week in April. I applied arsenate of lead, 2 lb. to 50 gallons water, with good results, though further demonstration spraying with this insect would prove beneficial. Its distribution is general, and it is probably the most serious of our pests.

THE OYSTER-SHELL SCALE (*Lepidosaphes ulmi*).

This insect requires little comment pertaining to its life-history, only as regards spraying during hatching season. At different points from Haney to Mission I found this scale hatching, and in some cases set by May 15th; while in 1912 it was about the first of June before similar conditions were noticed. This indicates a wide range, due to local climatic conditions.

THE TENT-CATERPILLAR (*Malacosoma erosa*).

These insects were hatched and well developed and doing considerable damage at Haney on May 20th, having almost entirely disappeared at Mission by June 12th.

THE OBLIQUE BANDED LEAF-ROLLER (*Archips rosaceana*).

This insect was very numerous in this city as well as on the Lower Fraser Valley this past summer. I am convinced that this insect can be easily controlled by the use of arsenate of lead applied about May 15th, judging from this season's observations.

THE ROSY APHIS (*Aphis sorbi*).

This aphis is proving to be a pest of marked importance and is spread over a large territory. It works on the opening foliage and is more difficult to control than other aphides, as it curls the leaf quicker than other species. In an orchard near Mission there was considerable damage caused by this insect during the two previous seasons. The aphis as a rule disappears to a large extent by the middle of June, and reoccurs on apple-trees in September. I believe this is about the time of their migration, but the secondary host as yet has not been learned. I have used Black Leaf 40, 1-800, on this aphis quite successfully, the essential point being earliness.

THE LESSER APPLE-WORM (*Enarmonia prunivora*).

It is indeed reasonable that this insect should demand its share of investigation. It existed in orchards where it had not been found before this summer. There are three or more distinct broods closely interwoven with one another, and quite frequently two larvæ of different broods were noticeable in an apple, one at each end. The first larvæ appeared about the middle of July, and the last about the middle of September. They were more numerous in orchards bordered by woods,

where the insect must hibernate. In the season of 1912, while spraying an old orchard near Abbotsford the first week in July, arsenate of lead was added to the spray. As the result of this experiment not half a dozen worms were found, while in the previous season this orchard was badly infested.

SPRAYING.

The value of spraying is often doubted by the average fruit-grower. But this misapprehension is largely due to an ignorance of results. It has been proven, however, that more consideration should be given spraying, both as to method and time of application, also the amount of material used. I have been requested to add a few practical facts on this subject.

The following is an estimate of some figures I have obtained concerning the cost of spraying. Lime and sulphur is sold at the rate of 27½ cents per 40-gallon barrel, and arsenate of lead at 14 cents per 100 lb. A five-year-old tree will require the use of ½ gallon of diluted spray, and a twenty-year-old tree 5 gallons of such spray. This may seem to be a close estimate, but using a power-sprayer with an equal pressure, and careful work, I have figured this to be 5 cents per five-year-old tree and 20 cents per twenty-year-old tree, or, as one good authority has stated, 1 cent per tree per year.

I am now desirous of making a few conclusive remarks relative to the best sprays to use, their number, also some results. I would unquestionably not omit the regular dormant spray of lime and sulphur applied at the time the buds are breaking, and the 1-3 scab sprays, the number of the latter depending on the season, with the first coinciding with the first lime-sulphur spray. Soluble sulphur has proven to be very effective, but its use as yet cannot be recommended for summer work. A fall spray of Bordeaux mixture should be applied to apple-trees for anthracnose, and one additional, if infection is very serious, according to the season.

From my experience of Fraser Valley conditions I realize that at the present status of our knowledge it is extremely difficult to lay down any definite rule which will cover any definite number of years and give equal results. As I have attempted to point out, especially as regards the spring development of buds and the consequent hatching of insects, in special reference, as this paper shows, to the oyster-shell scale, the season is extremely variable. I have no doubt that some years a single spray applied judiciously in the spring will accomplish as much as three sprayings could in an unfavourable year. During this past summer in particular, which was the driest we have experienced in the valley in twenty years, we did obtain good results with one spraying applied as the buds had well broken. In another year with a moist, wet spring the same results could not have been obtained with three sprayings. Consequently, we are down to this fact: that the individual fruit-grower in close co-operation with the Department of Horticulture will have to decide on the programme, one year with another.

As a general rule, however, allowing for the above-named limitations, I may say these three sprayings are required: (1) Winter spray, lime-sulphur, 1-9, with arsenate of lead, 2½-40 gallons, as the buds are breaking; (2) summer spray, lime-sulphur, 1-25 to 30, with arsenate of lead, 2½-40 gallons, after blossoming; (3) Bordeaux, 6-6-40, in the fall after the first rains (usually late in September or till October 15th).

Mr. Day: I am sure Mr. Getchell will be glad to answer any questions regarding his paper. There is one question I would like to ask; that is regarding the woolly aphis, which very often hibernates in the roots of the apple-trees. How would you control it?

Mr. Getchell: I think some have successfully combated it by applying tobacco-leaves to the roots, but for an orchard, personally I do not think it would be a very practical thing to do.

(Then followed a general discussion regarding the woolly aphis.)

Question: Have you any remedy to keep strawberry-plants from being destroyed? Sometimes when the plant is in full bearing it dies down, and the heart of the plant turns quite black.

Mr. Treherne: In our experience with strawberry-plants we find three distinct causes. The first is caused by the dampness of the soil that produces a rot of the root; secondly, of the leaf; this is due to the dampness of the soil, as well as the lack of lime in the soil. The soil around here would stand 2 tons of lime to the acre without doing any damage to it. Then the second cause is overproduction. The spring opens up so moderately that, unless a spring frost comes, we often get an overproduction of fruit, resulting in some dried-up strawberries. If the spring frost comes along and nips off a quarter or half of the blossoms, then you will have a good crop. Thirdly, you will find a white grub in the roots. These are the various causes, and I do not know to which one you refer.

Mr. Day: I will now call on Mr. W. H. Lyne, Assistant Inspector of Fruit Pests, Vancouver, to read his paper on "Remarks on the Life-history of Codling-moth on the Pacific Coast of British Columbia."

COMMENTS ON SOME PECULIARITIES IN CONNECTION WITH THE LIFE-HISTORY OF THE CODLING-MOTH ON THE PACIFIC COAST.

BY W. H. LYNE, ASSISTANT INSPECTOR OF FRUIT PESTS.

The history of the codling-moth on the Pacific Coast appears to have been a repetition of misunderstandings as to the insect's ability to acclimatize itself to the peculiar atmospheric conditions near the sea-coast. Perhaps the first locality to experience its mistake was Santa Cruz County, California, where it was prophesied that on account of the salt air and damp, foggy weather that prevailed so much during certain seasons, the codling-moth would not thrive, and if it managed to exist at all would never be of any economic importance.

However, the facts are these: that within ten years from the time of inception this industrious insect had become the scourge of the apple-growers in that locality; and so it has repeated its history at one point after another in California, Oregon, and Washington, until about five years ago we suddenly awakened to the fact that, although a few stray specimens were known to have been in existence for a few years previous in the Victoria and Saanich District on Vancouver Island, the codling-moth had finally demonstrated its ability to become just as great a pest and nuisance to the apple and pear growers of Vancouver Island as in many other places. The situation as discovered demanded immediate action on the part of those who were responsible for keeping the pest out of the Province, and it was during the campaign of exterminating this invader that special attention was paid to many details peculiar to its habits and life-history in general.

Just about this time there was considerable discussion by experts and others in the Western States as to whether the moth could be controlled with one application of arsenate of lead at the time blossoms were falling, or what is often termed "calyx-spraying," the aim being to fill the calyx-cup of the fruit, just forming, before it closed, after which the inside cavity is fortified against the attack of the young larva attempting to enter. Those in favour of one spraying appear to have been under the impression that nearly all the larvæ of the first brood entered the fruit by way of the calyx or blossom end, and by so doing consumed the poison in the calyx-cup, thus ending their career.

During the process of searching every tree for wormy fruit, in order to ascertain the amount of infection and destroy all that could be found, a close check was kept

as to which part of the apple or pear the larva made its entry, resulting in the following record:—

Year, 1909, Victoria District, commencing July 5th.	Infected Apples and Pears.	Larvæ entered Fruit at Calyx.	Entered Fruit at Points other than Calyx.	Doubtful.	Larvæ found under Bands.	Larvae found under Bark.
July	247	140	82	25	...	...
August	5,118	2,117	2,361	640	239	...
September	2,245	630	1,253	362	420	50
Totals	7,610	2,887	3,696	1,027	659	50

The table of infection proves that the greater number of moths hatched out between July 1st and August 15th, and during the whole season not more than 50 per cent. of the larvæ entered the fruit at the calyx, thus making it absolutely necessary to spray a second time at least, so that the enlarged surface of the fruit that had developed since the first spraying should be protected against the attack of the young larvæ that had hatched from the eggs deposited on the fruit by the moth, which did not commence to fly, or practically exist, until a month to six weeks after the first spraying. This, I think, proves clearly that the first spraying would only account for about 50 per cent. of the larvæ, which was all that made any attempt to enter at the point containing the poison,—viz., the calyx.

I think it well to say that I am fairly well acquainted with the literature published in the United States and Canada on the codling-moth, and have known that the majority of investigators have determined that about 75 per cent. enter at the calyx and 25 per cent. at other points. I am inclined to think that the records of Victoria, B.C., conditions, of 50 per cent. calyx-infection, are unique, so far as this point goes. I am satisfied to state that our records were made from a complete set of records, involving the entire area of infestation, where every apple was examined individually and carefully. When it can be shown that the entire outbreak involved the examination of 7,610 fruits, we were not able to go very far wrong.

This much may be said, however: that the calyx-infestation percentage was higher in the early summer, but it gradually decreased, with the result at the end of the period of hatching the points of entrance were equalled. This may be due to the gradual opening of the spring, accompanied by cool nights and a longer drawn-out emergence and hatching period of the moth.

Our records show that the first moths did not begin to hatch out from their winter cocoons until the middle of June, and very few were on the wing before July 1st; by the middle of September the pupating or hatching season was over, and the percentage of the second brood was so small as to be scarcely recognized.

Considerable difference of opinion exists as to the exact time for codling-moth spraying and the number of times to spray. Everything depends upon the peculiar characteristics and life-history of the moth in any or every district, as atmospheric conditions have everything to do with regard to the number of broods hatching out in the one season.

In order that the first or calyx spraying should be sufficient to control the infection, it would be necessary for all the first brood to enter at the calyx, but unfortunately, as has been shown, the larva chooses to use its own discretion as to just where and when it should enter the fruit. Some preferred to enter at the side, where two apples were touching, or in contact with a leaf or branch, while others entered at the stem end. No larva was discovered to have left the fruit until after the middle of August, proving that none of the worms infesting the fruit during that month were from a second brood. It required about thirty days for a larva to gain its full growth in the fruit. Those that pupated again during the same season were about twelve days from the date of leaving the fruit until hatching out to the new moth.

These details, on the whole, appear to tally pretty closely with the metamorphosis of the moth in other latitudes, with the exception that the number of broods per season are not so numerous this far north as they are to the south.

So far as our success of getting rid of the codling-moth on Vancouver Island is concerned, I felt quite safe the other day when I informed a gentleman that, if I gave him $5 on condition that he find me a codling-moth larva, he would think he had more than earned the money.

(Then followed a general discussion regarding the codling-moth.)

Mr. Day: I will now call on Mr. R. C. Treherne, Field Officer, Dominion Division of Entomology, Agassiz, to give his lecture on "Insects affecting Shade-trees and Ornamentals around Vancouver."

SHADE-TREE AND ORNAMENTAL INSECTS OF BRITISH COLUMBIA.

BY R. C. TREHERNE, FIELD OFFICER, ENTOMOLOGICAL BRANCH, DOMINION DEPARTMENT OF AGRICULTURE, AGASSIZ, B.C.

The subject I propose to take up to-day is naturally one that appeals to garden-lovers and those especially interested in the beautification of boulevards and parks. I do not propose to make an exhaustive study of all the insects found on shade-trees and ornamentals, but merely to touch upon certain of the more important and most noticeable, which year in and year out attract attention by their presence.

HEMIPTERA (TRUE BUGS).

SCALE-INSECTS.

Scale-insects are those which cover themselves with a waxy shield or scale, under which they lie protected and hidden from view. It is only necessary to draw your attention to the very familiar oyster-shell scale (*Lepidosaphes ulmi*) to give you an excellent illustration of the type of insect referred to as a "scale-insect." This oyster-shell scale occurs on a great many different species of shrubs and trees in this part of the world (*see* Bull. 5), and being very plentiful and numerous may readily be taken and studied, in a general way, as a type. Its common name indicates its appearance, and there is no other insect so readily available that has such characteristic markings. Beneath these protecting scales the soft-bodied insects lie immovable, but are able to grow and reproduce. Each one is furnished with a minute "sucker," which is inserted into the plant-tissue, thereby obtaining nourishment for itself.

Other scale-insects of ornamentals may be observed in the vicinity (Vancouver, B.C.), notably the following:—

The rose-scale (*Aulacaspis rosæ*).
The cottony maple-scale (*Pulvinaria innumerabilis* Rathv.).
The European fruit-scale (*Aspidiotus ostræformis*).
Lecanium spp. on maples, laurels, etc.
Chionaspis palm-scale (*Chrysomphalus dictyospermi*).

The cottony maple-scale, found on stems and twigs of maples and many rosaceous plants, presents a familiar appearance with its white cottony exudation beneath a brown shield or scale. The European fruit-scale, found on the mountain-ash, flowering crabs, etc., may be recognized as minute black specks with orange-coloured centres or "nipples." The Lecaniums, of which it is believed two species occur in Vancouver on maples, laurels, etc.—viz., *hemisphericum* and *hesperidum*—are known as somewhat large, spherical brown scales on the stems and leaves. All these scales may be controlled by the use of kerosene emulsion in the spring, or by caustic-soda applications during winter. The palm-scale is peculiar to plants and ferns in the greenhouse and conservatory, and the rose-scale has been taken in North Vancouver.

APHIDES.

These insects, commonly referred to as "green lice," form colonies on the leaves and twigs of plants they attack. The species frequently found on roses may be taken

as a type. Each species of plant, for the most part, has a different species of aphis attacking it, but despite the varietal differences all are similar in structure, and for the most part in habits also. They are soft-bodied creatures, slow-moving, usually green, brown, or covered with a whitey, woolly excretion. All are sucking-insects and can be controlled by applications of soapy solutions, kerosene emulsion, or caustic spray, the only requisite being necessary that each individual receive attention. Black Leaf 40 has been found particularly efficaceous and easy to apply.

THE TARNISHED PLANT-BUG (*Lygus pratensis*).

The malformations of such plants as chrysanthemums, dahlias, and asters, producing often a one-sided flower-development or sometimes a total "blighting" of the flower-bud, are due in a great many cases to the attack on the bud by the above-named insect. The adult is very active, about ¼ inch long, and darts away rapidly when approached; brown in general colour, but frequently adopting a yellowish or red tinge. The latest report on this insect (Cornell Bull. 346, June, 1914) records the satisfactory control as "still an unsolved problem." Under garden conditions sprays of nicotine or kerosene emulsion or dry applications of pyrethrum, sulphur, or ashes will give relief.

THE ROSE-LEAF HOPPER.

Frequently on the under-surfaces of rose-leaves a number of small white hopping insects may be observed. If the bush be disturbed these "hoppers" will fly out in great numbers. If careful watch be kept, it will be seen that each insect is methodically absorbing the juices of the leaf with its sucker inserted into the tissues of the plant. A peculiar white mottlish appearance shows on the upper surface of the attacked leaves. When these conditions are observed we are usually dealing with the above insect. Control of this insect, again, is a difficult matter, but careful sprays of nicotine or kerosene emulsion applied in May, preferably early in the morning, and especially directed to the under-surfaces of the leaves, will assist materially in the control.

SPITTLE-INSECTS (Cercopidæ).

These insects produce a peculiar saliva-like excretion on many plants in the herbaceous border and on grass. Within this liquid excretion a small yellow insect will be seen. During the past few years this insect has been the cause of much inquiry. Applications of kerosene emulsion or a strong driving force of water from a hose will destroy a number of these insects.

LEPIDOPTERA (BUTTERFLIES AND MOTHS).

THE OBLIQUE BANDED LEAF-ROLLER (*Archips rosaceana*) (Tortricidæ).

The larval form of butterflies and moths are referred to in general terms as caterpillars or "worms," and it is only in the larval form that they attract attention of the gardener. We have several insects in the vicinity of Vancouver which yearly cause damage by devouring the leaves and flowers of ornamentals. One of the most important in this regard are the caterpillars of the above moth. They are familiar to all amateur rose-gardeners and horticulturists.

They are usually light green in colour, with an evidence of a darker colour of green along the centre of the back; head very dark brown, almost black. They may be seen in the curl of some leaves, doing damage to both leaves and flowers by devouring the tissues. When disturbed they wriggle rapidly backwards and drop to the ground by means of a thread of silk. They quickly make a rose-garden look unsightly and the destruction of the bloom causes great inconvenience. The food-plants of this insect are very numerous, and from the number of egg-masses which may be seen by any one in this city (Vancouver, B.C.) on the trunks of maples, mountain-ashes, apples, and several other boulevard trees, as well as on the veranda woodwork, it is evident that it attacks more plants than actually have been observed

so far in these parts. It has been estimated that a single female moth will lay on the average of 305 eggs, and that a cluster of eggs will contain an average of 117 eggs, thus indicating that a single moth will deposit one or more clusters of eggs. (Sanderson.)

During the past winter I collected a number of these egg-masses and estimated that medium-sized clusters contained on the average of 48.5 eggs, with an average hatching fertility of 56.6 per cent. Parasites play an important part in the control of this insect during the summer, as has and may be shown by breeding tests, otherwise the former figures would indicate a serious outlook for the safety of our shade-trees. The brown moths fly in July and may be collected in thousands around the electric lights in the streets and on verandas.

As a control nicotine sulphate has been proven very efficacious, and infinitely more satisfactory to use on plants growing over verandas, steps, or trellis-work around houses than arsenate of lead, mainly for the reason that it does not mark the paint or woodwork. Arsenate of lead, apart from its unsightly effect in a rose-garden, is an admirable insecticide.

THE ROSE BUD-WORM (*Olethreutes sp.*) (Tortricidæ).

A species resembling the Eastern *nimbatana* has been taken here (Vancouver B.C.), reared from apple. Literature of the species records it under the above common name. Apparently its habits on the rose, as, indeed, the whole "make-up" of the larva itself, closely resembles the former species, *A. rosaceana*, so that the two are hardly distinguishable.

THE FRUIT-TREE LEAF-ROLLER (*Archips argyrospila*) (Tortricidæ).

This is another insect closely related and similar to the two foregoing Tortricidæ. It has been reared on the Pacific Coast from apple, and as it is a very general feeder on all kinds of ornamental shrubs and trees, there is little doubt it can also be incorporated in this article. The full-grown larva is dark green in colour, about ¾ inch in length, with the head, thoracic shield, and legs of brown.

THE ALFALFA-LOOPER (*Phylometia (Plusia) californica*) (Noctuidæ).

During the past season (1914) this insect has been prevalent. There was a serious outbreak recorded for the Okanagan during the early part of the summer. (*See* page 9.) Its attack on rhododendrons, laurels, hollies, roses, and several other shrubs and plants has attracted attention on the Coast. The larvæ are capable of completely defoliating a bush, and are recognized as olive-green caterpillars, with bright-green heads, mouth-parts brown, and black thoracic legs. When disturbed they curl up and drop to the ground, then refusing to move. Fortunately parasites played an important part in the control of these insects. While they were very common this past season, there is little likelihood of damage being caused in the 1915 season.

THE WEST COAST PAINTED-LADY (*Vanessa carye*) (Nymphalinæ).

The over-wintering butterflies of this species may often be taken in the first warm days of the spring. While the adult is one of the most beautiful of our Coast butterflies, the larvæ are by no means so prepossessing. During this past summer the caterpillars were plentiful on many malvaceous plants, and hollyhocks in particular suffered severely in Vancouver. Both *V. atlanta* and *V. cardui* occur on the Coast, the former being rare, while the latter may frequently be found on thistles. *Vanessa californica* is mainly confined to interior points of this Province on its natural food-plants of the Ceanothus family.

THE BLUES (Lycænidæ).

The larvæ of one of these butterflies this summer destroyed the appearance of patches of violets in the gardens of the city by riddling the leaves with feeding areas and in some cases by totally destroying the leaf.

THE TUSSOCK-MOTH (*Hemerocampa antiqua*) (Lymantriidæ).

During the past two summers the larvæ of this moth has been very destructive to azaleas, laurel hedges, and hollies in the city, and may be found on such trees on the boulevards as elm, birch, willow, poplar, maple, chestnut, ash, mountain-ash, as well as on the varieties of apple. The attack on the last-named trees is likely to pass notice until at a last moment, in a year of special prevalence, when parasites are limited, the attack becomes so marked that great damage results. City life is particularly suited to the growth and reproduction of this insect. The matter of control is a very simple matter, for the reason that the female is wingless, and consequently is forced to remain localized on one tree, provided it is not transported artificially or by contact of branches to another. At this time of year, during the winter, the egg-masses may be seen in a cluster of dead leaves still adhering to the trees on the streets. In the experience of other cities in Canada, notably to my knowledge in Toronto with *Hemerocampa leucostigma*, the attacks by this insect in past years has become so pronounced at times that the city authorities have found it expedient to follow the recommendations of the entomologists. Boys were employed on the bounty principle to collect these egg-masses during winter. Up till the present time Vancouver and other Coast cities have not suffered to any marked extent, but the presence of these caterpillars during the past two seasons would indicate that close watch should be kept for fear of an outbreak in the future.

THE TENT-CATERPILLAR (*Malacosoma erosa*) (Lasiocampidæ).

This is another insect which appears as a periodical destructive visitant. When it does occur it causes an extreme amount of damage to shade-trees and shrubs in these parts (Vancouver). It is fully dealt with in Bulletin No. 4 of our series; consequently it does not need to be mentioned to any extent here.

THE FALL WEB-WORM (*Hyphantria cunea*) (Arctiidæ).

During the past few years this insect has not been over-plentiful. During the years surrounding 1903 the webs of this Arctiid were "very conspicuous." It is my impression that it is again obtaining an ascendancy over its parasites, for the unsightly webs frequently recur to one's notice.

THE CUTWORMS (*Peridroma saucia*) (Noctuidæ).

Cutworms of all descriptions have proven themselves at times destructive, but the above species, this past summer and in former years in the Province and on the Coast, has been especially injurious to many kinds of plants in the garden. The greasy-looking worms are mostly nocturnal feeders, and only in cases of extreme prevalence do they adopt daylight-feeding habits. Frequently one finds a plant very badly defoliated or suddenly cut off at the ground, and for a time one is at a loss to assign the cause or observe the culprit. By carefully sifting the soil around the plant the cutworm may be found. If it belongs to the above species it will be, when full grown, about 1¾ inches in length, dull brown in colour, mottled grey or black, with a row of four to six yellow spots on the back. As a control for this class of insect a mixture of 50 lb. bran, sugar syrup, and 1 lb. Paris green, all mixed together and placed around a plant in the evening, will be effective.

THE DIAMOND-BACKED MOTH (*Plutella maculipennis*).

A small green worm measuring about ¼ inch or rather more when full grown has been very destructive this year, more so than in any of the past three years to my knowledge. Stocks and sweet peas suffered greatly, as did the cruciferous garden-truck crops. The larva is very active when disturbed and quickly falls to the ground. The cocoon is formed on the leaves of the plant attacked, and is recognized as a delicate silk gauze-like structure resembling a loose-mesh piece of lace. Within this cocoon the larva forms its pupa. There are at least two broods and probably a third supplementary brood in the Fraser Valley.

THE HEMLOCK-LOOPER (*Therina sp.*).

Two "loopers" occur on the Coast, one attacking hemlocks (Vancouver) and the other oaks (Victoria). The former, I believe, is referred to as *T. fervidaria*, while the latter has been called *T. somniaria*. I am not satisfied that we are entirely correct as to these specific names, and it is advisable to make more certain. The former species on the hemlock is one of the specially injurious in Stanley Park at the present time.

CEDAR-LEAF MINER.

The larva of a small moth is commonly to be found mining the leaves of the cedar. It is very prevalent in certain sections of Stanley Park, and greatly disfigures the trees. It will be recognized by its habits of turning the leaves brown and by producing a swelling on the affected leaf-tissues.

THE SPRUCE-CHERMES.

These and other insects affecting the timber of the Pacific Coast have been the subject of considerable investigation by Mr. J. M. Swaine, who has charge of forest-insect investigations under the Dominion Entomological Branch. It is to be hoped that when Mr. Swaine has completed his work, in which he is being assisted by Mr. R. N. Chrystal, he will be able to give our Society some of the benefits of his researches.

COLEOPTERA (BEETLES).

Otiorhynchus sulcatus.

A large white grub may frequently be found in and among the roots of several plants in the herbaceous border, notably in primulas. Frequent reports have been received in the city regarding this insect. It also has been observed affecting strawberries, and growers of this crop in a few cases have lost severely. The larvæ may be found embedded in the roots of the plants, actively devouring the tissues, while those specimens in the soil will devour the roots themselves. The result is that the plants die, the effect becoming most noticeable in the spring. The eggs of the species are laid during August, and the minute larvæ hatch in September, and become quarter-grown during the fall. A partial dormancy is experienced during the winter, but in the spring the attack again progresses. It is at this time that the plants suffer most. Pupæ are formed in the soil during May and June, and the adults appear in June and July.

A close relative, *O. ovatus*, is found to be the more injurious of the two species to the fruit-grower, but *O. sulcatus* has proved more important to the gardener. The life-histories of the two species closely resemble one another, and a report on *O. ovatus* with control measures may be seen in Bulletin No. 2 of our series, page 41.

CLICK-BEETLES (Elateridæ).

We have many species of click-beetles recorded in our proceedings; several of them have been shown to be injurious to blossoms of trees while in bloom. The damage, of course, to the fruit-grower is more serious than to the gardener, for the reason that the attack destroys the possibility of the resultant fruit. However, it is interesting to note that the adults of these beetles are also injurious to ornamentals.

CHRYSOMELIDS.

These leaf-feeding beetles at times pay us visits, as they did last summer, and frequently cause considerable harm. The species observed are not yet identified.

THE POPLAR-BORER (*Saperda calcarata*).

This beetle is also recorded for the Province as injurious to willows and poplars.

DIPTERA (FLIES).

There are two flies which are gaining in importance in the garden and greenhouses of Vancouver—viz., the chrysanthemum leaf-miner and the narcissus-fly. The former I reported in my paper of last year, and an account may be seen in Bulletin 4 of our series, as affecting white daisies and chrysanthemums. The latter, however, the narcissus-fly (*Merodon equestris*), while also reported on at length in the same Bulletin 4, requires further mention. I again wish to warn those who are interested that this insect is rapidly increasing its sphere of prevalence. During the past spring I observed an extraordinary bad attack from this insect just outside the city limits of Vancouver. Upwards of half an acre of bulbs, buried in the ground and neglected, were severely infested. This instance is only one of many in which careless growers of bulbs neglect their grounds to increase the breeding area of this insect. I understand that when there is no sale for the bulbs it is the practice by commercial gardeners to "heel" in the bulbs, trusting to make money by any chance blooms during the spring. This practice cannot be too strongly condemned, as the unfortunate private residents of the locality suffer as a direct result. I have known cases of individuals in the City of Vancouver who have failed to harvest their bulbs owing to this fly, and I have no doubt, further, that many bulbs suffer which we do not hear about.

Three years ago the Victoria District was suffering severely, and at that time we only had actual references of a few cases of infection in Vancouver. Last year the attack was noticed in private gardens, indicating an increase. This year I feel sure that it has increased to a remarkable extent, more so than we can gauge from exact data. Furthermore, Mr. Tom Wilson, Dominion Inspector of Indian Orchards, informs me that less than 1 per cent. of a large bed of daffodils planted on the All Hallows grounds at Yale, 150 miles inland, matured. The sisters in charge remarked on the condition and produced the insect in question.

To those who are not familiar with this insect will find references in Bulletins 1 and 4 of our series. It may be recognized as a large grub within the bulb of daffodils, causing a rot. Extreme care should be taken to examine the bulbs before planting, and, when, digging, to determine whether or not the bulb is infested. No bulb should be left undisturbed during the winter; all should be pulled up for spring planting.

OTHER ANIMALS.

THE LINDEN-TREE GALL.

The gall produced on the leaves of basswoods and lindens, and recorded mainly from Victoria, but also occurring at points inland, is referred to, in one of the late Dr. Fletcher's reports, as the work of *Eriophyes abnormis* Garman.

THE RED SPIDER (*Tetranychus bimaculatus*).

Early in spring, frequently showing activity in the month of February in the City of Vancouver, these mites may be seen, forming webs of fine silk over the trunks of many of our boulevard trees. Their presence on the trunks of trees is readily discernible, resembling in a way as if the trees were dusted with sawdust. I took active specimens on February 20th this year. To satisfy myself, specimens were forwarded to Dr. Nathan Banks, of the Washington, D.C., Bureau, and he believed them to be the above species.

THE CLOVER-MITE (*Bryobia pratensis*).

This mite also occurs in association with the red spider, causing discoloration of the leaves of ornamentals.

THRIPS.

According to Comstock's classification these insects belong to the Physopoda. If you tease open any flower you will usually find a large number of very minute, active creatures; these are usually Thrips. They may be found on very nearly

every kind of flower—viz., aster, dahlias, chrysanthemums, daisies, roses, and many others. The damage caused by them is often lost sight of, but in the order we have several economic pests, the most important, in our connection, being the greenhouse thrip, which is credited as being one of the most injurious of all greenhouse insects in these parts. As yet we have had no one to study these insects under our local conditions; consequently there is some excellent work ready at hand for those interested.

SLUGS.

Slugs in the soil in this part of the world frequently are met with, and their slimy nature make them very disagreeable. Their presence is largely accounted for by somewhat sour conditions of soil, such as we have in the city. Applications of lime will give relief.

MOLES.

According to Mr. E. M. Anderson, Museum, Victoria, we have two species in the immediate vicinity of Vancouver—viz., Townsend's mole (*Scopanus townsendi* Bach.) and Gibb's mole (*Neurotrichus gibbsi* Baird). The former is 6 inches in length, while the latter is only 3. They are both beneficial, though at times a nuisance.

Mr. Day: I shall now ask Mr. Tom Wilson to read his papers on: (*a.*) "The Oyster-shell Scale" (published in Bulletin 5). (*b.*) "The Remarkable Outbreak of Locusts of 1914."

THE OUTBREAK OF LOCUSTS OF 1914.

BY TOM WILSON, F.R.H.S., DOMINION INSPECTOR OF INDIAN ORCHARDS.

This past summer has been remarkable for an outbreak of locusts which occurred. The immense range areas of the Interior and the fruit lands of the Okanagan have suffered equally from the attack, each in its own respective manner.

True locusts, or short-horned grasshoppers, belong to the entomological family Acrididæ. Some of the most numerous and destructive insects belong to this family. They are widely dispersed throughout many different parts of the world, and do periodical damage in those different parts of the world. They are mentioned in many ancient writings; for instance, we read of a plague of locusts in ancient Egypt, a country which still is subject to occasional infestations. They are found in both the Old and New Worlds: Southern Europe, Algeria, India, South Africa, in the Eastern Hemisphere, and in the Argentine, Mexico, and some of the Western United States, as also on the Canadian great plains, and now, owing to several different trains of circumstance, in British Columbia.

The insects of this family have antennæ short, much more so than the body; the ovipositor of the female also short and composed of four separate plates; the tarsi are three-jointed. The hind legs are the longest and usually have stout femora, especially near the base.

Amongst those species of this family that did most damage during the past season, for there were several species involved, were *Melanoplus affinis* and *M. femur-rubrum*, the red-legged locust. The first district in which they came under the writer's notice was in the Similkameen Valley, near Princeton, about the middle of July. They were so numerous that the flight resembled a snow-storm. We found that crops of clover, alfalfa, and the ordinary hay-crops had been much injured, so much so as to bring about an appreciable shortage in weight per acre, while the ranges or cattle-grazing grounds had been rendered bare.

A little later in the season we were in the Okanagan country near Kelowna, and the same conditions were found to exist. In one young orchard which we visited, where that most reprehensible practice "clean cultivation" was being carried on, we found the locusts, after having eaten off the surrounding "range," were tackling

the young orchard trees. These trees seemed to have been planted about two years. Every tree would have a dozen or more locusts busily eating off the foliage, and even the young branches being stripped bare of leaves, petioles, and bark. Where the wood was too hard to cut off we found that in many cases the bark of the trunk had been girdled. I may say that it appeared that only on clean-cultivated orchards was this extreme injury found to be the case. Where there was a crop between the trees or where there were a few weeds along the roadside or by the fences, the trees were more or less untouched.

In the Spallumcheen country I found the locusts again very numerous, but doing no great amount of harm to farm or garden crops, owing, I suppose, to there being a goodly supply of their natural food. They had, however, denuded such shrubs as the saskatoon, wild roses, willows, buck-brush, etc.

The grazing-grounds in the vicinity of Nicola Lake were also severely attacked and many thousands of acres were rendered useless. Our Secretary, Mr. Treherne, made a special trip to the Nicola country to investigate the conditions of the outbreak. Possibly we may persuade him to tell us more of the exact conditions as they appeared to him. I will, however, leave that to him, as the work was done at the special request of the Dominion Entomologist in Ottawa, to whom the report was forwarded.

For the benefit of those of our members who may not be acquainted with the life-habits of this family of insects, I shall describe briefly the life-history of these creatures.

The eggs are laid underneath the surface of the soil in an egg-pod in shape something like a bent flask. Each of these pods contains from twenty-four to thirty-six eggs. Each female in her lifetime usually deposits two of these, though sometimes three or four may be laid by the same female. The insects pass the winter in the egg stage, and the young locusts hatch out in the spring. The period between hatching and maturity is from eighty to ninety days, and the grasshopper passes through several moults, usually four or five. Only after the last moult does the young grasshopper get its full wings. In about a week after reaching maturity the adults pair and oviposition commences.

The egg-masses during winter are largely preyed upon by the larvæ of blister-beetles, which devour the eggs readily. In connection with this, I may say that I found several species of blister-beetles in different parts of the interior of British Columbia during the past summer, notably *Cantharis cyanipennis*, which I found in large numbers in the Similkameen country usually congregated on the wild vetch. I found them both singly and in copula. They were also noticed in the Boundary country on vetches and alfalfa.

I mentioned in the beginning of this sketch that there were several circumstances which might have bearing on the present infestation and the reasons it should have reached the dimensions it did, because, like many other insects, we have the grasshoppers always with us, but not in such overpowering numbers.

The first reason I advance was the abnormally hot and dry season we have experienced, even for the Dry Belt. This condition was most conducive to the spread of these sun-loving dry-country insects. Second, the influx of settlers and the consequent diminution of the natural food of the locusts. Thirdly too heavy grazing on the range, or perhaps, more correctly stated, injudicious grazing on the range, has done away with the food-plants and forced the locusts to places where they could obtain the requisite amount of nutrition.

Mr. Treherne: Mr. Wilson has correctly stated that I made a short stay in the Nicola and Quilchena country investigating the outbreak of locusts that occurred the past summer. This was done at the request in the first place by the Forestry Branch of the Department of Lands, Victoria, and later by authorization from the Division of Entomology in Ottawa. A full report of my trip was forwarded in the usual manner to Ottawa, where a memorandum will no doubt be made out for the

benefit of the Forestry Branch and the ranchers of the Nicola Valley. Without trespassing on the grounds of this memorandum, I may say that I found that the spread of these locusts commenced from the Minnie and Courtenay Lake Districts, and that they travelled north at least as far as Kamloops, and extended west as far as Merritt and east as far as Kelowna. These areas are merely arbitrary as representing the probable centre of the infestation. The investigation into the Nicola country was begun in the first week of November, 1914, a very unpropitious time to study the adults, for very few could be found, and those adults found were dead and mutilated in the stacks of hay. The eggs were easily found, and in some instances in extreme numbers, indicating clearly that no disease of the adults had destroyed the females before their eggs had been laid. Where eggs were found in concentrated area, blister-beetle larvæ were also numerous enough, no doubt, to effect a fair means of control by next spring. Eggs on the range were normal and apparently healthy; consequently there is every indication that we shall again be bothered by the adults next summer unless one of the usual periodical diseases intervenes. I gathered that the outbreaks occur every seven years or so, and that the years when the locusts were most numerous and did most damage were 1889, 1898, 1907, and 1914, and that great damage was effected for about three years surrounding these dates. It is interesting to note that in one of Dr. Fletcher's old reports for 1898 (late Dominion Entomologist), on the authority of Dr. Scudder, the following species were involved: "The great mass of material was *Trimerotropis*, probably *cincta*." Out of the balance he made out the following species: *Camnulla pellucida*, *Cercotettix verruculatus*, and *Melanoplus atlanis*. These species were named from specimens from the Nicola District.

The next paper is one written by Mr. Lionel E. Taylor on "Notes on Birds likely to be of Service in the Destruction of Locusts in the Nicola Valley," and will ask Mr. Anderson to read this paper.

NOTES ON BIRDS LIKELY TO BE OF SERVICE IN THE DESTRUCTION OF GRASSHOPPERS IN THE NICOLA VALLEY.

BY LIONEL E. TAYLOR, F.Z.S., M.B.O.U., ASSOC.MEM.A.O.U.

The following notes are based on the reports on economic ornithology issued by the United States Department of Agriculture and from other sources; they do not pretend to be in any way complete, as the literature at my disposal is limited. The species of birds mentioned are those which may with some certainty be presumed to occur in the Nicola Valley in considerable numbers. There are many other species which occur in small numbers or at infrequent intervals, but these have been omitted, as it is not thought that they could be of economic importance.

It must be pointed out that almost all birds will eat grasshoppers at certain times, and especially when they are feeding their young. It is also important to note all investigation points to the fact that grasshoppers are exceedingly palatable to birds, and that when an incursion of these insects occurs a great many species of birds will depart from their usual diet and live almost entirely on grasshoppers.

Unfortunately there are no birds in this country which exist in such numbers as to be able to seriously cope with a large outbreak of grasshoppers as is the case in many other countries, and notably in Africa, where such birds as storks, pratincoles, kestrels, and others are capable of destroying entirely enormous swarms of locusts by their own efforts. In case, however, any doubt may exist on this point, I may mention that these flocks of birds frequently contain tens of thousands of individuals, and that they follow the swarms of locusts sometimes for weeks on end.

It must not be presumed from this that because we have no such enormous flocks of birds very litle good can result. In California, where grasshoppers are annually a plague in one part or another, often numbering twenty-five to the square yard, it is conceded that the birds are not able to cause an appreciable decrease in

the number of grasshoppers; but, at the same time, it was estimated that on a square mile in an infested area the birds accounted for 120,445 grasshoppers daily, which must mean an enormous saving of damage.

The following is a list of useful birds likely to occur in the Nicola Valley. The nomenclature is that of the A.O.U. Check-list, 3rd edition. It must be pointed out that the figures given as to the percentage of grasshoppers eaten does not always refer to the particular species or subspecies found here in the West, but to the Eastern form.

WESTERN MEADOW-LARK (*Sturnella neglecta*).

This will probably be found to be the greatest locust-destroyer, and being present in large numbers during the summer it is of great economic importance. The percentage of grasshoppers eaten is 29 per cent. for the year and 42 per cent. during August.

DESERT SPARROW-HAWK OR KITTY HAWK (*Falco sparverius phalæna*).

This bird ranks very high as a grasshopper-destroyer and is abundant everywhere during the summer. Of 410 stomachs examined, 314 contained insects mostly grasshoppers. I have seen a great number of these birds shot under the impression that they are destructive to poultry; this is a popular erroneous idea, and farmers should be warned against shooting them. It is very seldom that they take birds, especially chickens, and then only when they are very small.

ARKANSAS KINGBIRD (*Tyrannus verticalis*).

A very abundant species, with a great liking for grasshoppers; percentage for year, 20 per cent.

KINGBIRD (*Tyrannus tyrannus*).

Similar habits to the above.

WESTERN BLUEBIRD (*Sialia mexicana occidentalis*).

MOUNTAIN BLUEBIRD (*Sialia currucoides*).

Although it might not be expected that so small a bird as the bluebird would be capable of consuming many grasshoppers, yet these insects form 22 per cent. of its diet throughout the year and 60 per cent. during August and September.

WESTERN ROBIN (*Planesticus migratorius caurinus* Grinnell).

This bird, which is particularly common during the late summer, feeds on grasshoppers to the extent of 10 per cent for the year and 30 per cent. for August.

NORTHWESTERN CROW (*Corvus caurinus*).

Grasshoppers form the leading diet of this bird during August.

BLACK-HEADED JAY (*Cyanocitta stelleri annectens*).

Grasshoppers form 5 per cent. of the diet for the year, 14 per cent. for July, 18 per cent. for August, and 10 per cent. for September. They are not found in any numbers except in the wooded regions.

BREWER'S BLACKBIRD (*Euphagus cyanocephalus*).

In California this bird ranks with the meadow-lark in being the most useful grasshopper-destroyer.

COLUMBIA SHARP-TAILED GROUSE (*Pediocœtes phasianellus columbianus*).

Although this species is said not to be of such value as the true prairie-chicken, yet it is probable that they consume large quantities of grasshoppers late in the summer. From nine stomachs examined, six contained 174 grasshoppers.

BLUE GROUSE (*Dendragapus obscurus richardsoni*).

The young of this species is fed largely on grasshoppers; the stomach of one examined contained twenty.

NORTHERN SHRIKE (*Lanius borealis*).

This bird is only mentioned as it is one of the greatest grasshopper-destroyers, but unfortunately is not plentiful enough to be of any importance here.

KILDEER (*Oxyechus vociferus*).

This bird, which is plentiful here in summer, is of considerable value as a locust-destroyer.

Sparrows of various species are of considerable importance; in June, when the larger species of grasshoppers are young, they form 36 per cent. of their diet.

BATCHELDER'S WOODPECKER (*Dryobates pubescens homorous*).

Grasshoppers' eggs are said to be freely eaten by this species.

It is perhaps superfluous to add that domestic fowls and turkeys are amongst the greatest destroyers of grasshoppers, a fact which should not be overlooked when dealing with small areas.

The meeting adjourned until 8 p.m.

In the evening Dr. S. Hadwen, Veterinary Pathologist, gave a lantern-slide lecture on the Œstridæ. The lecture was well attended and an enthusiastic discussion took place.

The meeting adjourned at 10 p.m.

THE KANSAS REMEDY FOR THE CONTROL OF LOCUSTS.

BY ARTHUR GIBSON, IN CHARGE OF FIELD-CROP INSECT INVESTIGATIONS, ENTOMOLOGICAL BRANCH, OTTAWA.

In Entomological Circular No. 5 of the Dominion Department of Agriculture, which is now in press, and which is entitled "The Control of Locusts in Eastern Canada," I have given briefly the results in Eastern Canada following the use of the recently devised Kansas formula for the control of destructive locusts. Whenever opportunity occurs, we should be glad if farmers or others in British Columbia would try out this remedy and report to us, after the mixture has been given a fair trial.

The formula consists of: Bran, 20 lb.; Paris green, 1 lb.; molasses, 2 quarts; lemons, 3 fruits; water, 3½ gallons. The bran and Paris green are mixed thoroughly while dry. This may be done in a wash-tub or on a cement floor. The juice of the lemons is squeezed into the water, and to this is also added the pulp and peel after cutting into fine bits. The molasses should then be added, and when dissolved the mixture should be poured on to the dry bran and poison, stirring the whole constantly so as to dampen the bran thoroughly. When required for use, the bran-mash is sown broadcast in the infested locust areas early in the morning. The above quantity is sufficient to treat 5 acres. By scattering the mixture thinly a large number of locusts are killed, and when thus applied there is no danger of birds, poultry, or live stock securing a sufficient amount of the poison to kill them.

In our experiments near Ottawa, counts of dead locusts were made four days after the mixture had been broadcasted, and these gave from 50 to 414 to the square yard. In Quebec Province, however, from 900 to 1,200 dead per square yard were counted.

The Entomological Branch will be glad to correspond with farmers or others in British Columbia who may be troubled with locusts, or, as they are more commonly called, "grasshoppers." Specimens of the destructive species are desired. The circular above referred to will be sent to any one on request.

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